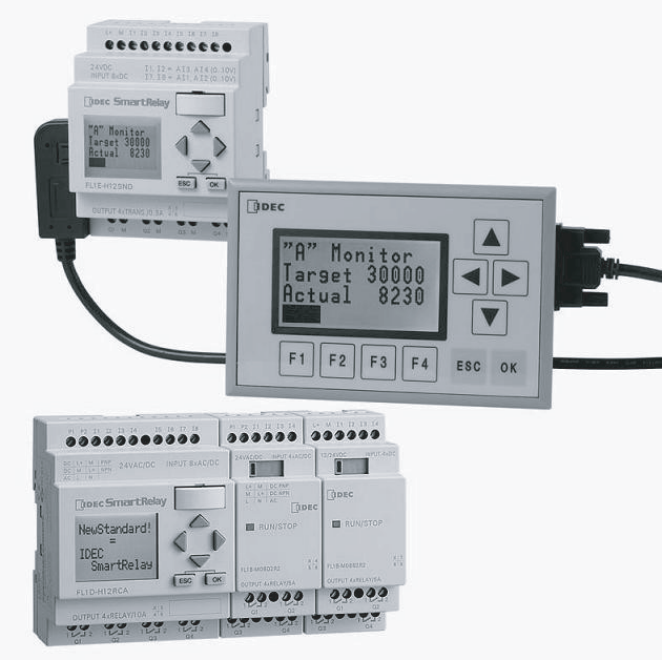
B-1090(5)

IDEC SmartRelay

FL1E series

IDEC SmartRelay

User's Manual



IDEC CORPORATION

Revision History

Date	Manual No.	Description
November, 2008	B-1090(0)	First print
December, 2008	B-1090(1)	Sensor connections for IDEC SmartRelay: FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCE / FL1E-B12RCE / FL1E-H12SND
February, 2009	B-1090(2)	• Compatibility (FL1C-PM3 memory cartridge in FL1E) • Compatibility (FL1E-PM4 memory cartridge in older IDEC SmartRelay modules)
July, 2009	B-1090(3)	Deleting the circuit program and password “Note”
September, 2009	B-1090(4)	• 1. The analog output module (FL1D-K2BM2) structure • 1. How to identify the IDEC SmartRelay (Analog output module) • 2.1.2 Setup with different voltage classes • 2.1.3 Compatibility (FL1D-K2BM2) • 2.2.3 Mounting the Text Display • 2.3.4 Connecting outputs, Output Internal Circuit (FL1D-K2BM2) • 3.6.5 Password • 3.6.5 Changing IDEC SmartRelay from RUN to STOP mode from the Text Display • 4.4.20 Analog amplifier (Analog output) • 6. Compatibility (FL1C-PM3 memory cartridge in FL1E) • 6. Compatibility (FL1E-PM4 memory cartridge in older IDEC SmartRelay modules) • A.1 General technical data (Degree of protection) • A.11 Technical data: FL1D-K2BM2 • E: Type Number (FL1D-K2BM2)
July, 2010	B-1090(5)	• 1. How to identify the IDEC SmartRelay (Base module) • 4.4.11 Seven-day time switch • 4.4.12 Twelve-month time switch • A.4 Technical data: FL1E-H12SND (Backup of the real-time clock at 25°C, Accuracy of the real-time clock) • E: Type Number (FL1E-H12SND)

Safety guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring to property damage only have no safety alert symbol. The notices shown below are graded according to the degree of danger.

Danger

indicates that death or severe personal injury will result if proper precautions are not taken.

Warning

indicates that death or severe personal injury may result if proper precautions are not taken.

Caution

with a safety alert symbol indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol indicates that property damage can result if proper precautions are not taken.

Note

indicates that an unintended result or situation can occur if the corresponding notice is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by qualified personnel. Within the context of the safety notices in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

Warning

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by IDEC.
Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Copyright © IDEC CORPORATION All rights reserved

The reproduction, distribution or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights reserved, in particular in the event of patents being granted or the registration of a utility model or design.

Disclaim of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Dear customer

We thank you for purchasing IDEC SmartRelay and congratulate you on your decision. With IDEC SmartRelay you have acquired a logic module that meets the stringent quality requirements of ISO 9001.
IDEC SmartRelay can be used in many fields of applications. Due to its high functionality and easy operation, IDEC SmartRelay offers you the utmost efficiency for almost any application.

Purpose of this manual

This IDEC SmartRelay manual provides you with information about the creation of circuit programs, about the installation and use of FL1E IDEC SmartRelay base modules, the Text Display and the IDEC SmartRelay expansion modules, and about their compatibility with the previous FL1A–FL1D versions (FL1x are the last four characters of the order number of the base modules and differentiate the device series).

IDEC SmartRelay's place in information technology

The wiring information in your IDEC SmartRelay manual is also found in the IDEC SmartRelay Product Info included with all devices. For further information on programming the IDEC SmartRelay on your PC, refer to the Online Help for WindLGC.
WindLGC is the programming software for PCs. It runs under Windows® (including Windows Vista®). It helps you to get started with IDEC SmartRelay and to write, test, print out and archive your programs, independent of the IDEC SmartRelay.

Guide

The manual is divided into 8 chapters:

- Getting started with IDEC SmartRelay
- IDEC SmartRelay installation and wiring
- Programming IDEC SmartRelay
- IDEC SmartRelay functions
- Configuring IDEC SmartRelay
- IDEC SmartRelay memory and battery cartridges
- IDEC SmartRelay software
- Applications

Valid range of this manual

The manual applies to devices of series FL1E.

New features of the FL1E IDEC SmartRelay device series

- The Text Display provides an additional display device for messages, and contains four cursor keys and four functions keys that can be used in the circuit program.
- An additional password protection function is available in the Text Display (version 4 or later) and can only be enabled when the Text Display is used together with IDEC SmartRelay Base modules (version 4 or later).
- The new IDEC SmartRelay Battery cartridge and the IDEC SmartRelay Combined Memory/Battery cartridge provide up to two years of backup time for the real-time clock. The new IDEC SmartRelay Memory cartridge and the Combined Memory/Battery cartridge provide 32 Kbytes memory space.
- Additional optional analog inputs and fast digital inputs are available on some of the FL1E IDEC SmartRelay base modules.
- FL1E IDEC SmartRelay configuration menus can be displayed in ten supported languages. You have a configuration choice to specify the language for IDEC SmartRelay menus.
- New instruction blocks are available: Pulse Width Modulator (PWM), Analog Math, and Analog Math Error Detection.
- Message texts can tick on and off the display; can include bar graphs, can switch between two character sets, and can be displayed on either the IDEC SmartRelay Display, the Text Display, or both. Full editing capabilities are available from WindLGC; editing from the IDEC SmartRelay base module is limited to simple text. See section 2.1.3 for further details.
- USB PC cable between a PC and IDEC SmartRelay base module is available as an option.
- You can now have up to 200 program blocks in your circuit program.

Additional differences compared to previous devices (FL1A to FL1D)

- Extended set of reference parameters for function blocks.
- Enhancements to up/down counter, Operating hours counter, Twelve-month time switch and analog watchdog instruction blocks.
- You can find information on compatibility of IDEC SmartRelay FL1E to previous devices at section 2.1.3.

Additional support

At our Internet address
http://smart.idec.com/
you can quickly and easily find answers to your queries about IDEC SmartRelay.

Contents

Preface iii

Contents vii

1 Getting started with IDEC SmartRelay 1

2 IDEC SmartRelay installation and wiring 17

2.1 Modular IDEC SmartRelay setup 20

2.1.1 Maximum setup 20

2.1.2 Setup with different voltage classes 22

2.1.3 Compatibility 24

2.2 Installing/removing IDEC SmartRelay 25

2.2.1 DIN rail mounting 26

2.2.2 Wall-mounting 29

2.2.3 Mounting the Text Display 30

2.3 Wiring IDEC SmartRelay 32

2.3.1 Connecting the power supply 33

2.3.2 Connecting the Text Display power supply 34

2.3.3 Connecting IDEC SmartRelay inputs 35

2.3.4 Connecting outputs 44

2.3.5 Connecting the AS interface bus 49

2.4 Putting into operation 51

2.4.1 Switching on the IDEC SmartRelay/Power On 51

2.4.2 Operating states 54

3 Programming IDEC SmartRelay 57

3.1 Connectors 58

3.2 Blocks and block numbers 60

3.3 From circuit diagram to IDEC SmartRelay program 63

3.4 The four golden rules for operating IDEC SmartRelay 66

3.5 Overview of IDEC SmartRelay menus 68

3.6 Writing and starting the circuit program 69

3.6.1 Selecting programming mode 69
3.6.2 The first circuit program 70
3.6.3 Circuit program input 72
3.6.4 Assigning a circuit program name 77
3.6.5 Password 78
3.6.6 Switching IDEC SmartRelay to RUN mode 84
3.6.7 Second circuit program 86
3.6.8 Deleting a block 92
3.6.9 Deleting block groups 93
3.6.10 Correcting programming errors 94
3.6.11 Selecting analog output values for RUN/STOP transition 94
3.6.12 Defining the type of analog outputs 95
3.6.13 Deleting the circuit program and password 96
3.6.14 Summertime/wintertime conversion 97
3.6.15 Synchronization 101

3.7 Memory space and circuit program size 103

4 IDEC SmartRelay functions 109

4.1 Constants and connectors - Co..... 110

4.2 Basic functions list - GF..... 114

4.2.1 AND 115
4.2.2 AND with Edge Detection 116
4.2.3 NAND (not AND) 116
4.2.4 NAND with Edge Detection 117
4.2.5 OR 118
4.2.6 NOR (not OR) 119
4.2.7 XOR (exclusive OR) 120
4.2.8 NOT (Negation, Inverter) 120

4.3 Special functions 121

4.3.1 Designation of the inputs 121
4.3.2 Time response 122

4.3.3 Backup of the real-time clock ... 123
4.3.4 Retentivity ... 123
4.3.5 Parameter protection ... 124
4.3.6 Calculating the gain and offset of analog values ... 125
4.4 Special functions list - SF ... 128
4.4.1 On-delay ... 131
4.4.2 Off-delay ... 135
4.4.3 On-/Off-delay ... 136
4.4.4 Retentive on-delay ... 138
4.4.5 Interval time-delay relay/Pulse output ... 139
4.4.6 Edge-triggered interval time-delay relay ... 140
4.4.7 Asynchronous pulse generator ... 142
4.4.8 Random generator ... 144
4.4.9 Stairwell Light Switch ... 146
4.4.10 Dual-function switch ... 148
4.4.11 Seven-day time switch ... 150
4.4.12 Twelve-month time switch ... 155
4.4.13 Up/down counter ... 161
4.4.14 Operating hours counter ... 164
4.4.15 Frequency trigger ... 168
4.4.16 Analog trigger ... 171
4.4.17 Analog differential trigger ... 174
4.4.18 Analog comparator ... 177
4.4.19 Analog watchdog ... 182
4.4.20 Analog amplifier ... 185
4.4.21 Latching relay ... 190
4.4.22 Current impulse relay ... 191
4.4.23 Message texts ... 193
4.4.24 Softkey ... 205
4.4.25 Shift register ... 208
4.4.26 Analog Multiplexer ... 210
4.4.27 Analog Ramp Control ... 212
4.4.28 PI controller ... 216
4.4.29 Pulse Width Modulator (PWM) ... 222

4.4.30 Analog math 225
4.4.31 Analog math error detection 230

5 Configuring IDEC SmartRelay 233

5.1 Selecting parameter assignment mode 234

5.1.1 Parameters 235
5.1.2 Selecting the parameters..... 236
5.1.3 Modifying parameters 237

5.2 Setting the default values for IDEC SmartRelay 239

5.2.1 Setting the time of day and date (FL1E-H12RC...) 240
5.2.2 Setting the display contrast and backlight choice 241
5.2.3 Setting the menu language..... 243
5.2.4 Setting the number of AIs in the base module..... 244
5.2.5 Setting the start screen 245

6 IDEC SmartRelay memory and battery cartridge (card) 247

6.1 Security function (CopyProtect)..... 250

6.2 Inserting and removing memory and battery cartridges 252

6.3 Copying data from IDEC SmartRelay to the memory cartridge..... 254

6.4 Copying data from the memory cartridge to IDEC SmartRelay 256

7 IDEC SmartRelay software.....259

7.1 Connecting IDEC SmartRelay to a PC 261

8 Applications 263

8.1 Stairway or corridor lighting..... 265

8.1.1 Requirements for a stairway lighting system 265
8.1.2 Previous solution 265
8.1.3 Lighting system with IDEC SmartRelay..... 266

8.1.4 Special features and expansion options 268
8.2 Automatic door 269
8.2.1 Requirements of an automatic door 269
8.2.2 Conventional solution 270
8.2.3 Door control system with IDEC SmartRelay 270
8.2.4 Special features and expansion options 273
8.2.5 Extended solution with FL1E-H12RCC 273
8.3 Air-conditioning system 276
8.3.1 Requirements for an air-conditioning system 276
8.3.2 Advantages of using IDEC SmartRelay 279
8.4 Factory door 281
8.4.1 Requirements for a gate control system 281
8.4.2 Previous solution 282
8.4.3 Extended IDEC SmartRelay solution 284
8.5 Centralized control and monitoring of several factory doors ... 285
8.5.1 Requirements for a gate control system 286
8.6 Luminous rows 289
8.6.1 Requirements for a lighting system 289
8.6.2 Previous solution 290
8.6.3 Luminous row control system with FL1E-H12RCC 291
8.7 Service water pump 293
8.7.1 Requirements for a control system of a service water pump 294
8.7.2 Previous solution 294
8.7.3 Service water pump system with FL1E-H12RCC 295
8.7.4 Special features and expansions 296
A Technical data 297
A.1 General technical data 297
A.2 Technical data: FL1E-H12RCC/FL1E-B12RCC 299
A.3 Technical data: FL1B-M08C2R2 302
A.4 Technical data: FL1E-H12SND 305

A.5 Technical data: FL1B-M08B1S2 307
A.6 Technical data: FL1E-H12RCA/FL1E-B12RCA 309
A.7 Technical data: FL1B-M08D2R2 312
A.8 Technical data: FL1E-H12RCE/ FL1E-B12RCE and FL1B-M08B2R2 314
A.9 Switching capacity and service life of the relay outputs 317
A.10 Technical data: FL1B-J2B2 318
A.11 Technical data: FL1D-K2B2, FL1D-K2BM2 319
A.12 Technical data: Text Display 320
B Determining the cycle time 321
C IDEC SmartRelay without display 325
D IDEC SmartRelay menu structure 329
D.1 IDEC SmartRelay base module 329
D.2 Text Display 331
E Type Numbers 333
Index 335

1 Getting started with IDEC SmartRelay

Here's IDEC SmartRelay

IDEC SmartRelay is a universal logic module made by IDEC that integrates:

- Controls
- Operator and display panel with background lighting
- Power supply
- Interface for expansion modules
- Interface for a memory cartridge, battery cartridge, combined memory/battery cartridge, IDEC SmartRelay PC cable or USB PC cable
- Interface for an optional text display (TD) module
- Pre-configured standard functions, for example, on-and off-delays, current impulse relay and softkey
- Timers
- Digital and analog memory markers
- Inputs and outputs, according to the device type

What IDEC SmartRelay can do for you

IDEC SmartRelay offers solutions for domestic and installation engineering applications such as stairway lighting, external lighting, sun blinds, shutters, shop window lighting and more; switch cabinet engineering, as well as for mechanical and apparatus engineering such as gate control systems, air-conditioning systems, rand ainwater pumps.

IDEC SmartRelay can also be implemented for special control systems in conservatories or greenhouses, for control signal processing and, by connecting a communication module such as an AS-i module, for distributed local controlling of machines and processes.

Special versions without operator panel and display unit are available for series production applications in small machine, apparatus, switching cabinet and installation engineering.

Which devices are available?

IDEC SmartRelay Base is available in two voltage classes:

- Class 1 ≤ 24 V, i.e. 12 V DC, 24 V DC, 24 V AC
- Class 2 > 24 V, i.e. 100...240 V AC/DC

IDEC SmartRelay Base is available in two versions:

- **With display**: 8 inputs and 4 outputs
- **Without display** ("IDEC SmartRelay Pure"): 8 inputs and 4 outputs

Each version is integrated into four subunits, is equipped with an expansion interface and Text Display interface and provides 39 pre-configured standard and special function blocks for the creation of your circuit program.

Which expansion modules are available?

- IDEC SmartRelay digital modules are available for operation with 12 V DC, 24 V AC/DC and 100...240 V AC/DC, and are equipped with four inputs and four outputs.
- IDEC SmartRelay analog modules are available for operation with 24 V DC and some with 12 V DC, depending on the specific module. Each is equipped with two analog inputs or two analog outputs.

The digital/analog modules are integrated in two or four subunits. Each one is equipped with two expansion interfaces for connecting additional modules.

Which display modules are available?

- IDEC SmartRelay Base with display
- Text Display

Features of the Text Display

The Text Display is available with the FL1E series. It provides an additional display that is wider than the Base module. It has four function keys that you can program in your circuit program as inputs. Like the IDEC SmartRelay Base module, it has four cursor keys, an ESC key and an OK key that you can also program in your circuit program and use for navigation on the Text Display.

You can create and download a power-up screen for the Text Display from WindLGC. This screen displays briefly when you initially power on the Text Display. You can also upload the power-up screen from the Text Display to WindLGC.

The menus for the Text Display are shown in Appendix section D.2. You configure the settings for the Text Display independently from the IDEC SmartRelay Base module. The settings can be different.

Which communication modules are available?

- IDEC SmartRelay communication module (CM) AS interface, which is described in more detail in a separate documentation.

  The communication module has four virtual inputs and outputs, and acts as an interface between an AS-Interface system and an IDEC SmartRelay system. The module enables four data bits to be transferred from the IDEC SmartRelay base module to the AS-Interface system and vice versa.

It's your choice

The various IDEC SmartRelay Base versions, expansion modules, Text Display and communication modules offer you a highly flexible and adaptive system to suit your specific tasks.

The IDEC SmartRelay system offers you many solutions such as for small domestic installations, simple automation tasks, and even complex engineering tasks involving its integration into a bus system (e.g. communication module AS interface).

Note

IDEC SmartRelay base module may only be equipped with expansion modules of the same voltage class. Mechanical encoding pins in the housing prevent you from connecting devices of a different voltage class.

Exception: The left-hand interface of an analog module or communication module is galvanically isolated.

This type of expansion module can therefore be connected to devices of a different voltage class. See also Chapter 2.1.

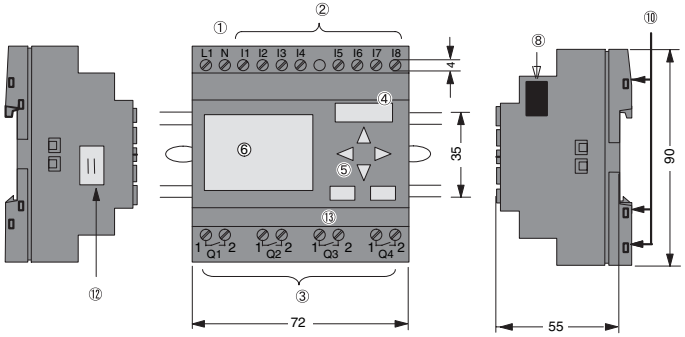
A Text Display, if used, can be connected only to an FL1E IDEC SmartRelay base module.

Each IDEC SmartRelay base module supports the following connections for the creation of the circuit program, regardless of the number of connected modules:

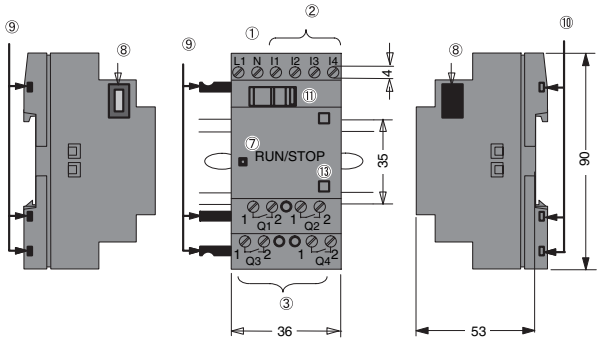
- Inputs I1 to I24
- Analog inputs AI1 to AI8
- Outputs Q1 to Q16
- Analog outputs AQ1 and AQ2
- Memory Markers M1 to M27:
  - M8: Startup marker
  - M25: Backlight flag: IDEC SmartRelay Display
  - M26: Backlight flag: Text Display
  - M27: Message text character set flag
- Analog Memory Markers AM1 to AM6
- Shift register bits S1 to S8
- 4 cursor keys
- 16 blank outputs X1 to X16

The IDEC SmartRelay structure

IDEC SmartRelay Base
(e.g.: FL1E-H12RCC)

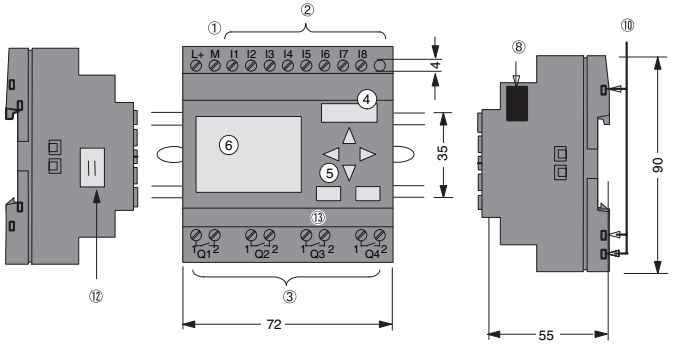


IDEC SmartRelay
expansion module
(e.g.: FL1B-M08C2R2)

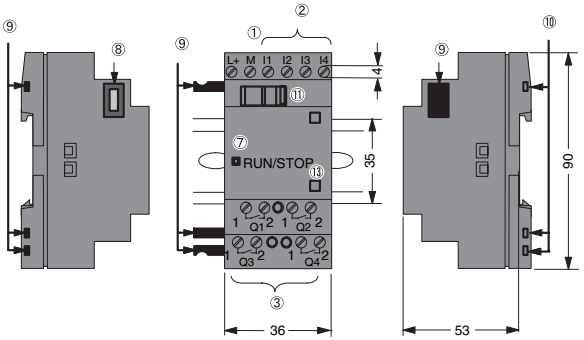


① Power supply	⑤ Control panel (not for FL1E-B12...)	⑨ Mechanical coding pins
② Inputs	⑥ LCD (not for FL1E-B12...)	⑩ Mechanical coding sockets
③ Outputs	⑦ RUN/STOP indicator	⑪ Slide
④ Module slot with cap	⑧ Expansion interface	⑫ Text Display cable connector
		⑬ Version number (example: $\frac{X|2}{3|4}$ represents Version 1.)

IDEC SmartRelay Base
(e.g.: FL1E-H12RCE)

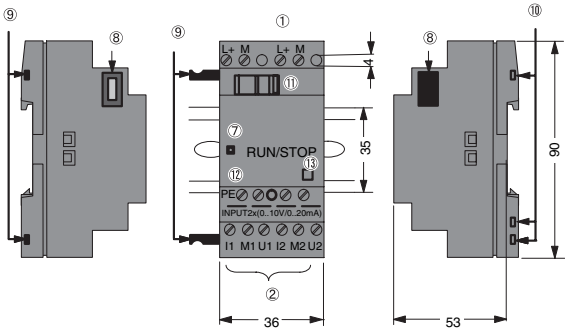


IDEC SmartRelay
expansion module
(e.g.: FL1B-M08B2R2)



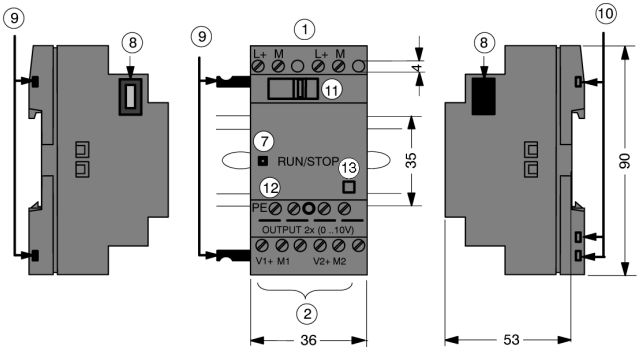
① Power supply	⑤ Control panel (not for FL1E-B12...)	⑨ Mechanical coding pins
② Inputs	⑥ LCD (not for FL1E-B12...)	⑩ Mechanical coding sockets
③ Outputs	⑦ RUN/STOP indicator	⑪ Slide
④ Module slot with cap	⑧ Expansion interface	⑫ Text Display cable connector
		⑬ Version number

FL1B-J2B2



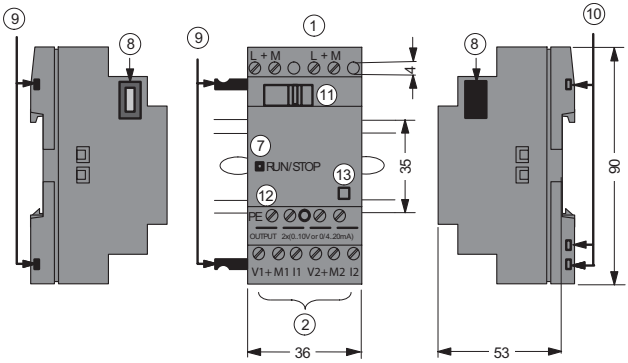
① Power supply
② Inputs
⑦ RUN/STOP indicator
⑧ Expansion interface
⑨ Mechanical coding pins
⑩ Mechanical coding sockets
⑪ Slide
⑫ PE terminal, for connecting earth and the shielding of analog measuring cables.
⑬ Version number

FL1D-K2B2



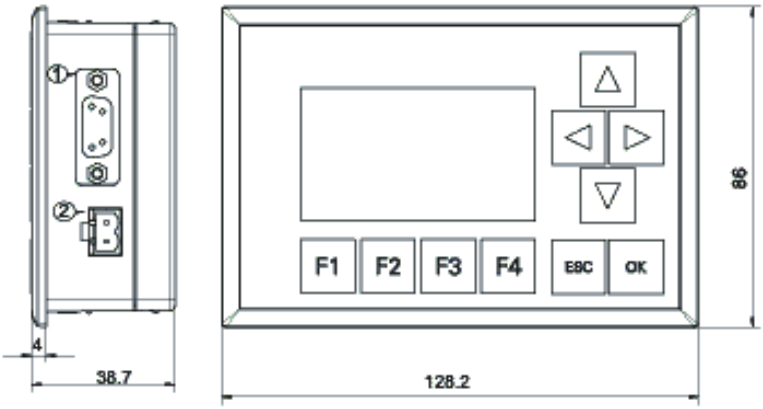
① Power supply
② Outputs
⑦ RUN/STOP indicator
⑧ Expansion interface
⑨ Mechanical coding pins
⑩ Mechanical coding sockets
⑪ Slide
⑫ PE terminal, for connecting earth
⑬ Version number

FL1D-K2BM2



① Power supply	⑧ Expansion interface	⑪ Slide
② Outputs	⑨ Mechanical coding pins	⑫ PE terminal, for connecting earth
⑦ RUN/STOP indicator	⑩ Mechanical coding sockets	⑬ Version number

Text Display



① Communication interface
② Power supply

The Text Display includes a wider display area than the IDEC SmartRelay Display. It includes four programmable cursor keys, four programmable function keys, and an ESC and OK key. You use the included Text Display cable to connect from the communication interface on the right side of the Text Display to the corresponding interface on the left side of the IDEC SmartRelay base module.

How to identify the IDEC SmartRelay

The IDEC SmartRelay identifier informs you of various properties.
Base module
FL1E-①②③④⑤

① B: Base module without display
H: Base module with display
② Number of Inputs and Outputs
③ R: Relay output S: Tr. (source) output
④ C: With clock N: Without clock *
⑤ D: 24V DC E: 12/24V DC A: 24V AC/DC
B: 100...240V AC C: 100...240V AC/DC

*: FL1E-H12SND (version 5 or later) has a real-time clock. For identifying the version, see page 5.

Expansion module
Digital module
FL1B-M①②③④
① Number of Inputs and Outputs
② B1: 24V DC B2: 12/24V DC
C2: 100...240V AC/DC D2: 24V AC/DC
③ S: Tr. (source) output R: Relay output
④ Terminal type 2: non-removable terminal

Analog input module
FL1B-J①②③
① Number of Inputs
② Resolution B: 10bit
③ Terminal type 2: non-removable terminal

Analog output module
FL1D-K①②③④
① Number of Outputs
② Resolution B: 10bit
③ blank: 0 ... 10V M: 0 ... 10V, 0/4 ... 20 mA
④ Terminal type 2: non-removable terminal

Communication module
FL1B-①②③④
① C: Communication module
② L1: LONWORKS AS: AS-Interface
③ blank: AS-Interface rated voltage (30V DC) C1: 24V AC/DC
④ Terminal type 2: non-removable terminal

Text Display
FL1E-①②
① RD: Remote Display
② Version type

Symbols

Version with display unit is equipped with 8 inputs and 4 outputs

Version without display unit is equipped with 8 inputs and 4 outputs

The digital module is equipped with 4 digital inputs and 4 digital outputs

The analog module is equipped with 2 analog inputs or two analog outputs, according to the device type

The communication module (CM); for example, AS Interface is equipped with 4 virtual inputs and 4 virtual outputs

The Text Display

Versions

The following IDEC SmartRelay versions are available:

Symbol	Designation	Supply voltage	Inputs	Outputs	Properties
	FL1E-H12RCE	12/24 V DC	8 digital (1)	4 relays (10 A)	
	FL1E-H12SND	24 V DC	8 digital (1)	4 solid state 24V / 0.3A	no clock
	FL1E-H12RCA (3)	24 V AC/ 24 V DC	8 digital	4 relays (10A)	
	FL1E-H12RCC (2)	100...240 V AC/DC	8 digital	4 relays (10A)	
	FL1E-B12RCE	12/24 V DC	8 digital (1)	4 relays (10A)	no display unit no keyboard
	FL1E-B12RCA (3)	24 V AC / 24 V DC	8 digital	4 relays (10A)	no display unit no keyboard
	FL1E-B12RCC (2)	100...240 V AC/DC	8 digital	4 relays (10A)	no display unit no keyboard

(1): Of those can be used alternatively: 4 analog inputs (0 ... 10V) and 4 fast inputs.
(2): AC versions: Two groups consisting of 4 inputs each. Each input within a group must be connected to the same phase. It is possible to interconnect groups with a different phase.
(3): The digital inputs can be operated with P or N action.

Expansion modules

The following expansion modules can be connected to IDEC SmartRelay:

Symbol	Name	Power supply	Inputs	Outputs
	FL1B-M08B2R2	12/24 V DC	4 digital	4 relays (5A)
	FL1B-M08B1S2	24 V DC	4 digital	4 solid state 24V / 0.3A
	FL1B-M08D2R2 (3)	24 V AC/DC	4 digital	4 relays (5A)
	FL1B-M08C2R2	100...240 V AC/DC	4 digital (1)	4 relays (5A)
	FL1B-J2B2	12/24 V DC	2 analog 0 ... 10V or 0 ... 20mA(2)	none
	FL1D-K2B2	24 V DC	none	2 analog 0 ... 10 V DC
	FL1D-K2BM2	24 V DC	none	2 analog 0 ... 10 V DC, 0/4 ... 20 mA (4)

(1): Different phases are not allowed within the inputs.
(2): 0 ... 10 V, 0 ... 20 mA can be connected optionally.
(3): Digital inputs can be operated either with P or with N action.
(4): 0 ... 10 V, 0/4 ... 20 mA can be connected optionally.

Communication modules

The following communication modules can be connected to IDEC SmartRelay:

Symbol	Name	Power supply	Inputs	Outputs
	IDEC Smart-Relay CM AS Interface	30 V DC	the next four inputs after the physical inputs of IDEC SmartRelay (I_n ... I_{n+3})	the next four outputs after the physical outputs of IDEC SmartRelay (Q_n ... Q_{n+3})

Text Display Module

The following Text Display module is available:

Symbol	Name	Supply voltage	Display
	Text Display	24 V AC/DC 12 V DC	LCD (128 x 64) 4-row display

Certification and approvals

IDEC SmartRelay is certified to cULus and FM.

- cULus Haz. Loc.
  Underwriters Laboratories Inc. (UL) to
  - UL 508 (Industrial Control Equipment)
  - CSA C22.2 No. 142 (Process Control Equipment)
  - UL 1604 (Hazardous Location)
  - CSA–213 (Hazardous Location)

  APPROVED for use in
  Class I, Division 2, Group A, B, C, D Tx
  Class I, Zone 2, Group IIC Tx

- FM Approval
  Factory Mutual Research (FM) to
  Approval Standard Class Number 3611, 3600, 3810
  APPROVED for use in
  Class I, Division 2, Group A, B, C, D Tx
  Class I, Zone 2, Group IIC Tx
  For further information, see our Internet address
  (URL: http://www.idec.com/usen)

Note

You will find current approvals on the rating plate of the relevant module.

IDEC SmartRelay is issued with the CE Certificate of Conformity. It is compliant with IEC 60730-1 and IEC 61131-2 and interference-proof to EN 55011, Limit Class B.

Marine certification has been requested.

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- GL (Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

IDEC SmartRelay modules are therefore suitable for use in industrial and residential areas. Use in Class I, Division 2, Group A, B, C and D locations or in non-hazardous locations is supported.

Marine certification requires the surge protective device what manufactured by DEHN+SÖHNE GmbH+Co., in a case of 12/24V DC or 24V DC power line. The required Type No. and Part No.: BVT AD 24, 918 402. See Note on page 298.
For further information, see our Internet address (URL: http://www.idec.com/usen)

ID for Australia

Our products carrying the label shown at the side are compliant with AS/NZS 2064:1997 (Class A) standard.

Warning

Risk of death, personal injury or property damage can occur if you do not follow safety precautions for hazardous locations.

In potentially explosive atmospheres, do not disconnect connectors when the system is in RUN. Always switch off the power supply to IDEC SmartRelay and its components before you disconnect any connectors or components.

Substitution of components can impair suitability for Class I, Division 2 locations. Combinations of equipment are subject to investigation by the local authority having jurisdiction at the time of installation.

Recycling and Disposal

IDEC SmartRelay units can be fully recycled, due to their low-pollutant equipment. Contact a certified electronic waste disposal center for environmentally acceptable recycling and disposal of your old devices.

IDEC SmartRelay installation and wiring

2

General guidelines

Please note the following guidelines for installing and wiring your IDEC SmartRelay:

- Always ensure that the wiring of your IDEC SmartRelay is compliant with current rules and standards. Also, conform with all national and regional regulations when you install and operate the devices. For information on standards and regulations that apply to your specific case, contact your local authorities.
- Always switch off power before you wire or install/remove a module.
- Always use cables with appropriate conductor cross-sections for the relevant current. You can wire IDEC SmartRelay with cable conductor cross-sections from 1.5 mm^2 to 2.5 mm^2; see Chapter 2.3.
- Do not exceed the screw torque of the terminals. The maximum torque is: 0.5 Nm, see Chapter 2.3.
- Keep the cabling as short as possible. If longer cables are necessary, you should use shielded versions. You should always route your cables in pairs: i.e. one neutral conductor plus one phase conductor or signal line.
- Always keep separate:
  - The AC wiring
  - High-voltage DC circuits with high-frequency switching cycles
  - Low-voltage signal wiring
- Ensure that the wires are installed with appropriate strain relief.
- Provide a suitable lightning surge arrester for cables installed in hazardous areas.
- Do not connect an external power supply in parallel to the output load of a DC output. This could develop a reverse current at the output if you have not installed a diode or similar barrier device.
- Reliable functioning of the equipment is only ensured with certified components!

Note

IDEC SmartRelay devices may only be installed and wired by skilled personnel who are familiar with and follow general engineering rules and relevant regulations and standards.

What you must note when installing

IDEC SmartRelay is designed for fixed and enclosed installation in the housing or the control cabinet.

Warning

Death, serious bodily injury or considerable damage to property can occur.

Modules of an IDEC SmartRelay are open facilities. This means that you must install IDEC SmartRelay only in a housing or cabinet.

Allow access to the housings or cabinets only with the use of a key or a tool and only allow access to authorized or approved personnel.

It is permissible to operate IDEC SmartRelay from the front at any time.

Safety of electronic control equipment

Introduction

The notes below apply regardless of the type or manufacturer of the electronic control.

Reliability

Maximum reliability of IDEC SmartRelay devices and components is achieved by implementing extensive and cost-effective measures during development and manufacture.

This includes the following:

- Use of high-quality components
- Worst-case design of all circuits
- Systematic and computer-aided testing of all components
- Burn-in of all large-scale integrated circuits (e.g. processors, memory, etc.)
- Measures preventing static charge when handling MOS ICs
- Visual checks at different stages of manufacture
- Continuous heat-run test at elevated ambient temperature over a period of several days
- Careful computer-controlled final testing
- Statistical evaluation of all returned systems and components to enable the immediate initiation of suitable corrective measures
- Monitoring of major control components, using online tests (cyclic interrupt for the CPU, etc.)

These measures are referred to as basic measures.

Carrying out tests

You must, however, ensure safety in your plant.

Before finally commissioning a system, carry out complete functional testing as well as all the necessary safety testing.

In testing, also include any predictable faults that can occur. This means that you will avoid any danger to the plant or to people during operation.

Risks

In all cases where the occurrence of failures can result in material damage or injury to persons, special measures must be taken to enhance the safety of the installation – and therefore also of the situation. System-specific and special regulations exist for such applications. They must be observed on installing the control system (for example, VDE 0116 for burner control systems).

For electronic control equipment with a safety function, the measures that have to be taken to prevent or rectify faults are based on the risks involved in the installation. Beyond a certain degree of hazard the basic measures mentioned above are not sufficient. Additional measures must be implemented and approved for the controller.

Important information

The instructions in the operating manual must be followed exactly. Incorrect handling can render measures intended to prevent dangerous faults ineffective, or generate additional sources of danger.

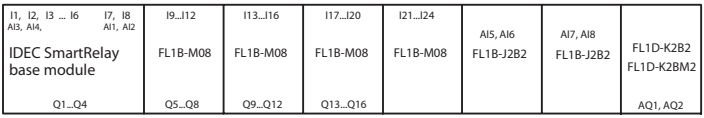
2.1 Modular IDEC SmartRelay setup

2.1.1 Maximum setup

As defined in Chapter 1, IDEC SmartRelay supports a maximum of 24 digital inputs, 8 analog inputs, 16 digital outputs, and 2 analog outputs. You can achieve the maximum setup in different ways as shown below:

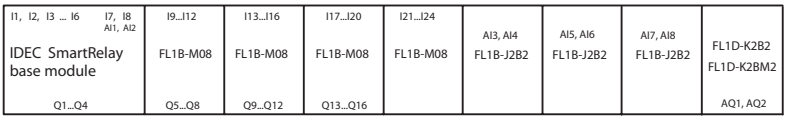
Maximum setup of an IDEC SmartRelay *with* analog inputs - four in use (FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND)

IDEC SmartRelay base module, 4 digital modules, 2 analog modules and 1 analog output module (example)



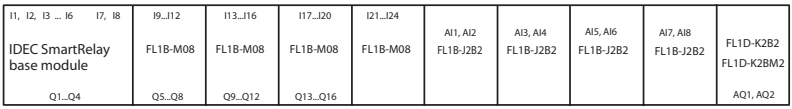
Maximum setup of an IDEC SmartRelay *with* analog inputs - two in use (FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND)

IDEC SmartRelay base module, 4 digital modules, 3 analog modules and 1 analog output module (example)



Maximum setup of an IDEC SmartRelay *without* analog inputs (FL1E-H12RCA/FL1E-B12RCA and FL1E-H12RCC/FL1E-B12RCC)

IDEC SmartRelay base module, 4 digital modules, 4 analog modules and 1 analog output module (example)



With any setup, you can plug in an analog output module, which has the maximum of two analog outputs.

For FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND modules, you can configure whether the module uses two or four of the four possible analog inputs. AI inputs are numbered consecutively depending on how many you configure the base module to use. If you configure two inputs, they are numbered AI1 and AI2, and correspond to the I7 and I8 input terminals. Subsequent AI expansions modules would begin numbering at AI3. If you configure four inputs, they are numbered AI1, AI2, AI3, and AI4, and correspond to I7, I8, I1, and I2 in that order. Subsequent AI expansions modules would begin numbering at AI5. See sections 4.1 and 5.2.4.

High-speed/optimal communication performance

For optimal and high-speed communication performance between IDEC SmartRelay base module and the various modules, we recommend that you install the digital modules first, then the analog modules (examples above). (The special function PI controller is an exception: the AI used for the value PV should be on the IDEC SmartRelay base module or an analog input module adjacent to the IDEC SmartRelay base module).

We **recommend** that you position the CM AS Interface on the far right-hand side. (If the AS Interface voltage fails, communication between the IDEC SmartRelay system and expansion modules that are arranged to the right of the IDEC SmartRelay CM AS Interface expansion module is interrupted).

The Text Display module is installed separately. You connect it to the IDEC SmartRelay base module with the included Text Display cable.

2.1.2 Setup with different voltage classes

Rules

Digital modules can only be directly connected to devices of the same voltage class.

You can connect analog and communication modules to devices of any voltage class.

Overview: Connecting an expansion module to IDEC SmartRelay base module

In the following tables, “X” means that the connection is possible; “-” means that the connection is not possible.

IDEC SmartRelay base module	Expansion modules					
	FL1B-M08B2R2	FL1B-M08B1S2	FL1B-M08D2R2	FL1B-M08C2R2	FL1B-J2B2, FL1D-K2B2, FL1D-K2BM2	CM
FL1E-H12RCE	x	x	x	-	x	x
FL1E-H12SND	x	x	x	-	x	x
FL1E-H12RCA	x	x	x	-	x	x
FL1E-H12RCC	-	-	-	x	x	x
FL1E-B12RCE	x	x	x	-	x	x
FL1E-B12RCA	x	x	x	-	x	x
FL1E-B12RCC	-	-	-	x	x	x

Overview: Connecting an additional expansion module to an expansion module

Expansion module	Additional expansion modules					
	FL1B-M08B2R2	FL1B-M08B1S2	FL1B-M08D2R2	FL1B-M08C2R2	FL1B-J2B2, FL1D-K2B2, FL1D-K2BM2	CM
FL1B-M08B2R2	x	x	x	-	x	x
FL1B-M08B1S2	x	x	x	-	x	x
FL1B-M08D2R2	x	x	x	-	x	x
FL1B-M08C2R2	-	-	-	x	x	x
FL1B-J2B2, FL1D-K2B2 FL1D-K2BM2	x	x	x	-	x	x
CM AS Interface	x	x	x	-	x	x

When setting up expansion modules of different power voltages, take the following restrictions into consideration.

Note

When you use a 24V DC power supply to supply power to 12/24V DC power type base module and 24V DC power type expansion I/O modules, use a 24V DC power supply which starts up within 10 seconds, otherwise the base module does not recognize the expansion I/O modules. When the power supply voltage varies while the base module and the expansion I/O modules are operating, they normally operate within the permissible operating voltage range.
When using different power supplies, supply power to the base module and expansion modules at the same time, or supply power to expansion modules before the base module.When supplying power to expansion modules after the base module, expansion modules may not be recognized by the base module.
When using different power supplies, the fast transient/burst immunity (IEC61000-4-4) will be 1 kV (power supply).
A 100 to 240V AC/DC module cannot be connected to the right side of a 12/24V DC, 24V DC, or 24V AC/DC module.
For analog input module and AS-Interface communication module, a module of any voltage can be connected to the left side. To the right side, however, a 100 to 240V AC/DC module cannot be connected.

2.1.3 Compatibility

The Text Display module can only be used with equipment series FL1E.

You cannot edit message texts from the IDEC SmartRelay base module that contain any of the following parameters:

- Par
- Time
- Date
- EnTime
- EnDate

You can only edit such message texts from WindLGC.

When using FL1D-K2B2 and FL1D-K2BM2 with equipment series FL1C or FL1D, the functions are limited to the ones available on this equipment. You cannot use the module with equipment series FL1B or earlier.

All other expansion modules are completely compatible with the basic modules of equipment series FL1B, FL1C, FL1D, and FL1E.

2.2 Installing/removing IDEC SmartRelay

Dimensions

The IDEC SmartRelay installation dimensions are compliant with DIN 43880.

IDEC SmartRelay can be snap–mounted to 35 mm DIN rails to EN 50022 or on the wall.

IDEC SmartRelay width:

- Text Display has a width of 128.2 mm, which corresponds to 8 subunits
- IDEC SmartRelay base modules have a width of 72 mm, which corresponds to 4 subunits
- IDEC SmartRelay expansion modules have a width of 36 mm, which corresponds to 2 or 4 subunits

Note

The figure below shows you an example of the installation and removal of a FL1E-H12RCC and a digital module. The measures shown apply to all other IDEC SmartRelay Base versions and expansion modules

Warning

Always switch off power before you “remove” and “insert” an expansion module.

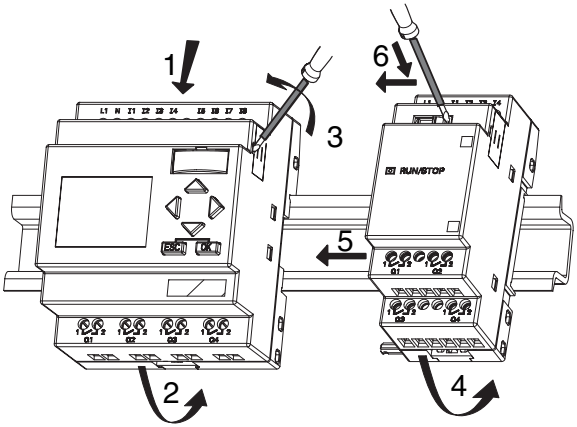
2.2.1 DIN rail mounting

Mounting

How to **mount** an IDEC SmartRelay base module **and** a digital module onto a DIN rail:

IDEC SmartRelay base module:

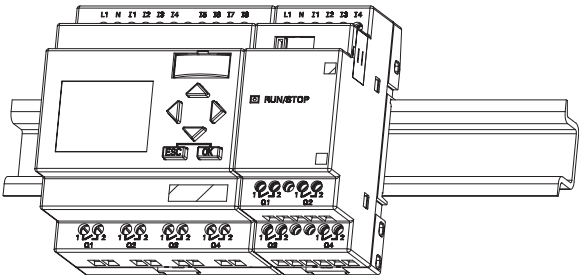
1. Hook the IDEC SmartRelay base module onto the rail.
2. Push down the lower end to snap it on. The mounting interlock at the rear must engage.



IDEC SmartRelay digital module:

3. On the right side of the IDEC SmartRelay base module/ IDEC SmartRelay expansion module, remove the connector cap.
4. Place the digital module onto the DIN rail on the right-hand side of the IDEC SmartRelay base module.
5. Slide the digital module towards the left until it contacts the IDEC SmartRelay base module.

6. Using a screwdriver, push the interlock to the left. In its end position the slide interlock engages in IDEC SmartRelay base module.



Repeat steps 3 through 6 to mount further expansion modules.

Note

The expansion interface on the last expansion module must be covered.

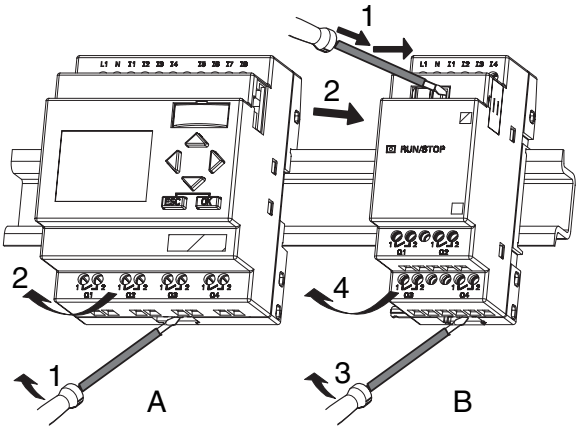
Removal

To **remove** IDEC SmartRelay:

..... if you have installed **only one IDEC SmartRelay base module**:

Part **A**

1. Insert a screwdriver into the eyelet at the bottom of the slide interlock and move the latch downward.
2. Swing the IDEC SmartRelay base module off the DIN rail.



..... if you have connected **at least one expansion module** to IDEC SmartRelay base module:

Part **B**

1. Using a screwdriver, push the integrate slide interlock to the right.
2. Slide the expansion module off towards the right.
3. Insert a screwdriver into the eyelet at the bottom of the slide interlock and lever it downward.
4. Swing the expansion module off the profile rail.

Repeat steps 1 to 4 for all other expansion modules.

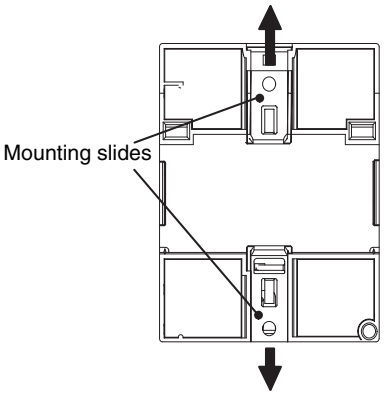
Note

If you have connected more than one expansion module, it is advisable to start removal with the last module at the right-hand side.

Make sure the slide interlock of the module to be installed/removed is not engaged in the next module.

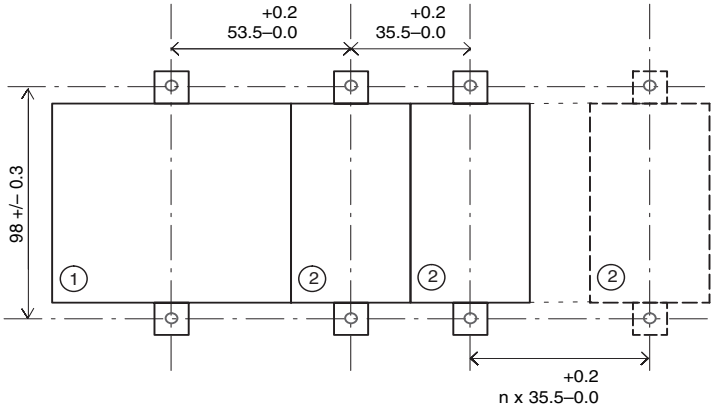
2.2.2 Wall-mounting

For wall-mounting, first slide the mounting slides on the rear side of the devices towards the **outside**. You can now wall-mount IDEC SmartRelay by means of two mounting slides and two ϕ M4 screws (tightening torque 0.8 to 1.2 Nm).



Drilling template for wall-mounting

Before you can wall-mount IDEC SmartRelay, you need to drill holes using the template shown below.



All dimensions in mm

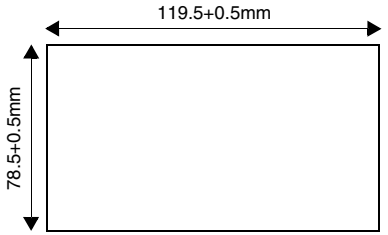
Bore hole for ϕ M4 screw, tightening torque 0.8 to 1.2 Nm

1) IDEC SmartRelay base module
2) IDEC SmartRelay expansion modules

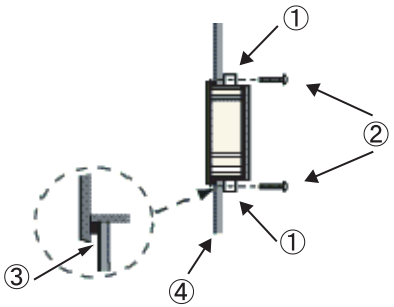
2.2.3 Mounting the Text Display

To prepare the mounting surface for the optional Text Display and mount it, follow these steps:

1. Cut a 119.5 mm x 78.5 mm hole in the mounting surface.



2. Place the included gasket on the frontplate of the Text Display.
3. Fit the Text Display into the cutout you made in the mounting surface.
4. Attach the mounting brackets (included) to the Text Display.
5. Tighten the mounting screws on the mounting brackets to 0.15...0.2 Nm torque to secure the Text Display.



① Mounting brackets
② Mounting screws
③ Gasket
④ Cabinet door or control panel (Thickness: 1.5 to 4 mm)

You can then use the included cable to connect the Text Display to the IDEC SmartRelay base module up to a distance of 2.5 meters. You can extend this distance to up to ten meters by using a standard Sub-D cable together with the Text Display cable.

Note

The number of supplied mounting screws and brackets on the FL1E-RD1 text display depends on the version. The version number of the FL1E-RD1 is found in the lower-right corner on the back of the module. For identifying the version, see page 5.

For versions 3 and earlier, 2 screws and brackets are provided.

For versions 4 and later, 4 screws and brackets are provided. Listed by UL type 4x / 12 for a tightening torque of 0.2 Nm.

2.3 Wiring IDEC SmartRelay

Wire IDEC SmartRelay using a screwdriver with a 3-mm blade.

You do not need wire ferrules for the terminals. You can use conductors with cross-sections of up to the following thicknesses:

- 1 x 2.5 mm^2
- 2 x 1.5 mm^2 for each second terminal chamber

Tightening torque: 0.4...0.5 Nm or 3...4 in-lbs.

Recommended ferrules

Ferrules order No.
For 1-cable connection

Cross-section [mm^2]	AWG	Phoenix Contact Ferrule type No.	NIC HIFU Blade Terminals type No.	NIC HIFU Insulated Pin Terminals type No.
0.3	22	AI0,5-10WH	BT1.25-10-1	–
0.5	20	AI0,5-10WH		TGN-TC-1.25-11T
0.75	18	AI0,75-8GY		
1.25	18	AI1,5-8BK	BT1.25-10-1 BT2-9-1	
2.0	16	AI2,5-8BU	BT2-9-1	–
Recommended crimping tool		CRIMPFOX ZA 3	NH1 NH61	NH11 NH32 NH65

For 2-cable connection

Cross-section [mm^2]	AWG	Phoenix Contact Ferrule type No.
0.3	22	AI-TWIN2X0,5-8WH
0.5	20	AI-TWIN2X0,5-8WH
0.75	18	AI-TWIN2X0,75-8GY
1.25	18	AI-TWIN2X1,5-8BK
Recommended crimping tool		CRIMPFOX ZA 3

Note

Always cover the terminals after you have completed the installation. To protect IDEC SmartRelay adequately from impermissible contact to live parts, comply with local standards.

2.3.1 Connecting the power supply

IDEC SmartRelays (FL1E-*12RCC, FL1B-M08C2R2) are suitable for nominal line voltages of 100 V AC/DC and 240 V AC/DC. IDEC SmartRelays (FL1E-*12RCA, FL1B-M08D2R2) are suitable for a supply voltage of 24 V AC/DC. IDEC SmartRelays (FL1E-H12SND, FL1B-M08B1S2) are suitable for a supply voltage of 24 V DC. IDEC SmartRelays (FL1E-*12RCE, FL1B-M08B2R2) are suitable for a supply voltage of 12 V AC/DC or 24 V AC/DC.
Note the information on connection in the product information document shipped with your device and the technical specifications in Appendix A relating to permissible voltage tolerances, line frequency and current consumption.

The Text Display must be supplied with a voltage of 12 V DC or 24 V AC/DC.

Note

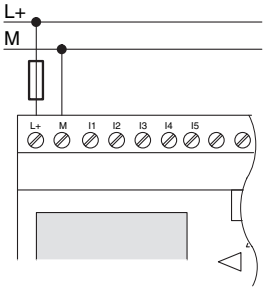
A power failure might cause an additional edge triggering signal at the special functions.

The stored data will be from the last uninterrupted cycle.

Connecting IDEC SmartRelay

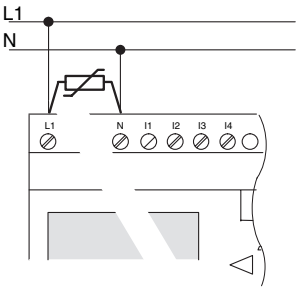
To connect IDEC SmartRelay to the power supply:

IDEC SmartRelay ..... with DC power supply



Protection with safety fuse if required (recommended) for:
FL1E-H12RCE: 0.8 A
FL1E-H12SND: 2.0 A

IDEC SmartRelay ..... with AC power supply



To suppress surge voltages, install varistors (MOV) with an operating voltage at least 20 % above the rated voltage.

Note

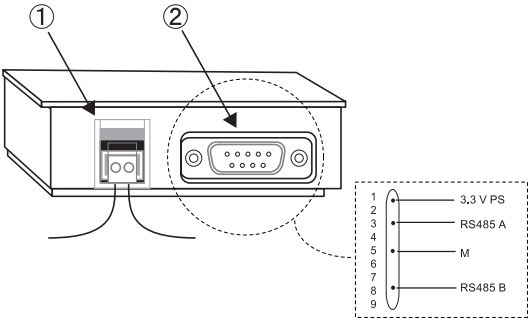
IDEC SmartRelay is a double-insulated switchgear. You do not need to connect an equipment grounding conductor.

Circuit protection with AC voltage

To suppress voltage peaks on the power supply lines, you can install a metal oxide varistor (MOV). Make sure the operating voltage of the varistor (MOV) used lies at least 20 % above the rated voltage.

2.3.2 Connecting the Text Display power supply

The Text Display must be connected to an external power supply that supplies a voltage of 12 V DC or 24 V AC/DC. A power connector is included with the Text Display.



① Power supply
② Communication interface

The power connection is non-polar. If you connect a DC power supply to the Text Display, you can connect the positive supply wire or negative supply wire to either the left or right side.

Note

IDEC recommends that you protect the Text Display with a 0.5 A safety fuse on the power supply.

2.3.3 Connecting IDEC SmartRelay inputs

Requirements

At the inputs you connect sensor elements such as: momentary pushbuttons, switches, light barriers, daylight control switches etc.

Sensor characteristics for IDEC SmartRelay

	FL1E-H12RCE/ FL1E-B12RCE		FL1E-H12SND		FL1B-M08B2R2	FL1B-M08B1S2
	I3 ... I6	I1,I2,I7,I8	I3 ... I6	I1,I2,I7,I8	I1 ... I8	I1 ... I8
Signal status 0	< 5 V DC	< 5 V DC	< 5 V DC	< 5 V DC	< 5 V DC	< 5 V DC
Input current	< 0.85 mA	< 0.05 mA	< 0.85 mA	< 0.05 mA	< 0.85 mA (1)	< 0.85 mA (3)
Signal status 1	> 8.5 V DC	> 8.5 V DC	> 12 V DC	> 12 V DC	> 8.5 V DC (2)	> 12 V DC (4)
Input current	> 1.5 mA	> 0.1 mA	> 2 mA	> 0.15 mA	> 1.5 mA	> 2 mA (5)

	FL1E-H12RCA/ FL1E-B12RCA FL1B-M08D2R2 (AC)	FL1E-H12RCA/ FL1E-B12RCA FL1B-M08D2R2 (DC)	FL1E-H12RCC/ FL1E-B12RCC FL1B-M08C2R2 (AC)	FL1E-H12RCC/ FL1E-B12RCC FL1B-M08C2R2 (AC)
Signal status 0	< 5 V AC	< 5 V DC	< 40 V AC	< 30 V DC
Input current	< 1.0 mA	< 1.0 mA	< 0.03 mA	< 0.03 mA
Signal status 1	> 12 V AC	> 12 V DC	> 79 V AC	> 79 V DC
Input current	> 2.5 mA	> 2.5 mA	> 0.08 mA	> 0.08 mA

(1): 1.0 mA (Version 1 to 5 specifications)
(2): 8 V DC (Version 1 to 5 specifications)
(3): 1.0 mA (Version 1 to 4 specifications)
(4): 8 V DC (Version 1 to 4 specifications)
(5): 1.5 mA (Version 1 to 4 specifications)

Note

The digital inputs of FL1E-H12RCC/FL1E-B12RCC are divided into two groups, each consisting of four inputs. **Within** the same group, all inputs must be operated on the **same** phase. **Different** phases are only possible **between** the groups.

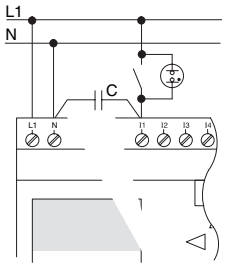
Example: I1 to I4 on phase **L1**, I5 to I8 on phase **L2**.

Inputs within the FL1B-M08C2R2 may **not** be connected to different phases.

Sensor connections

Connecting glow lamps and 2-wire proximity switches (Bero) to FL1E-H12RCC/FL1E-B12RCC or FL1B-M08C2R2 (AC)

The figure below shows how you connect a switch with a glow lamp to IDEC SmartRelay. The current that flows through the glow lamp allows IDEC SmartRelay to detect a “1” signal even though the switch contact is not closed. If, however, you use a switch the glow lamp of which is fitted with a power supply, this response does not occur.



X-capacitor 2.5 kV, 100 nF

Take into account the quiescent current of any 2-wire proximity switches used. The level of the quiescent current of some 2-wire proximity switches is high enough to trigger a logical ”1” signal at the IDEC SmartRelay input. You should therefore compare the quiescent current of the proximity switches with the technical data of inputs in Appendix A.

Remedy

To suppress this response, use an X capacitor rated at 100 nF and 2.5 kV. In a destructive situation, this type of capacitor safely disconnects. You must choose the voltage level for which the capacitor is rated such that it is not destroyed in the case of overvoltage!
At 230 V AC, the voltage between N and an input I(n) must not be greater than 40 V to guarantee a ”0” signal. You can connect approximately ten glow lamps to the capacitor.

Restrictions

Signal status transitions 0 → 1 / 1 → 0:
After a 0 to 1 or 1 to 0 transition, the signal must remain constant at the input at least for the duration of one program cycle, so that IDEC SmartRelay can detect the new signal status.
The program execution time is determined by the size of the circuit program. Appendix B contains a benchmark test routine that you can use to determine the current scan cycle time.

Special features of FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND

Fast inputs: I3, I4, I5 and I6:

These versions are also equipped with fast inputs (up/down counters, frequency triggers). The restrictions mentioned earlier do not apply to these fast inputs.

Note

The fast inputs I3, I4, I5 and I6 are the same as in the previous versions FL1A to FL1D; therefore, a circuit program that is written in these versions can be transferred to the new FL1E devices with the programming software WindLGC, without any changes to these features. The fast inputs have increased from 2 kHz to 5 kHz with the FL1E series.

Expansion modules do not have fast inputs.

Analog inputs: I1 and I2, I7 and I8:

The inputs I1, I2, I7 and I8 of IDEC SmartRelay versions FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND can be used as either digital inputs or analog inputs. The input mode is defined in the IDEC SmartRelay circuit program.

The inputs I1, I2, I7 and I8 provide digital inputs, and the inputs AI3, AI4, AI1 and AI2 provide analog inputs, as described in Chapter 4.1. AI3 corresponds to the input terminal I1; AI4 corresponds to I2; AI1 corresponds to I7; AI2 corresponds to I8. The use of AI3 and AI4 is optional. You configure your IDEC SmartRelay to use either two or four analog inputs as described in section 5.2.4.

When using inputs I1, I2, I7 and I8 as analog inputs, only the range from 0 to 10 V DC is available.

Connecting a potentiometer to inputs I1, I2, I7 and I8

To allow you to achieve 10 V as the maximum value when you completely turn the potentiometer once, you must connect a series resistor on the potentiometer's input side regardless of the input voltage (see figure below).

We suggest the following sizes of potentiometers and associated series resistors:

Voltage	Potentiometer	Series Resistor
12 V	5 kΩ	-
24 V	5 kΩ	6.6 kΩ

When using a potentiometer and 10 V input voltage as the maximum value, you must ensure that with a connected input voltage of 24 V, 14 V must release via the series resistor so that a maximum of 10 V are supplied when you turn the potentiometer one full rotation. With a voltage of 12 V, this can be neglected.

Note

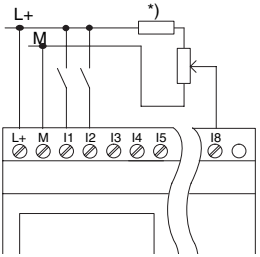
The FL1B-J2B2 expansion module provides additional analog inputs.

Always use twisted and shielded cables for analog signals, and keep these as short as possible.

Sensor connections

To connect sensors to IDEC SmartRelay :

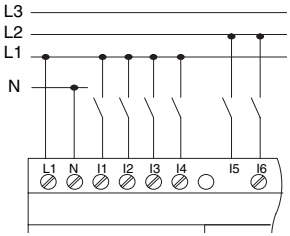
FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCE / FL1E-B12RCE / FL1E-H12SND



The inputs of these devices are not isolated and therefore require a common reference potential (chassis ground). With FL1E-H12RCE / FL1E-B12RCE and FL1E-H12SND modules, you can tap analog signals between the supply voltage and chassis ground (* = series resistor (6.6 kΩ) with 24 V DC).

On the FL1E-H12RCA/-B12RCA, P1 and P2 are indicated in place of L+ and M, respectively.

FL1E-H12RCC / FL1E-B12RCC

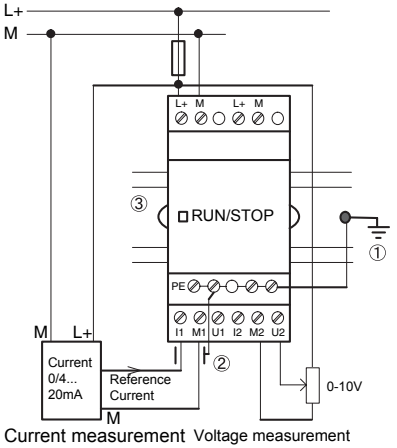


The inputs of these devices are arranged in 2 groups, each consisting of 4 inputs. Different phases are only possible between blocks, but not within the blocks.

Warning

Current safety regulations (VDE 0110, ... and IEC 61131-2, ... as well as cULus) do not permit the connection of different phases to an AC input group (I1 to I4 or I5 to I8) or to the inputs of a digital module.

FL1B-J2B2



PE PE terminal for connecting earth and shielding the analog measuring cable

① Earth
② Cable shielding
③ DIN rail

The illustration above shows an example of four–wire current measurement and two–wire voltage measurement.

Connecting a two–wire sensor to the FL1B-J2B2

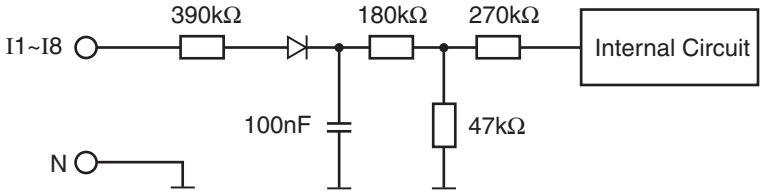
Wire up the two–wire sensor's connecting wires as follows:

1. Connect the sensor's output to connection U (0 ... 10 V voltage measurement) or to connection I (0/4 ... 20 mA current measurement) of the FL1B-J2B2 module.
2. Connect the plus connector on the sensor to the 24 V supply voltage (L+).
3. Connect the ground connection of the current output M (on the right side of the sensor, as shown in the figure above) to the corresponding M input (M1 or M2) on the FL1B-J2B2 module.

Input Internal Circuit

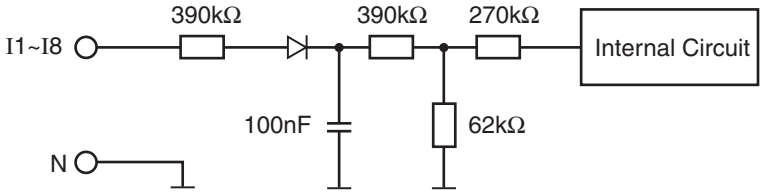
FL1E-H12RCC / FL1E-B12RCC

Digital AC/DC Input

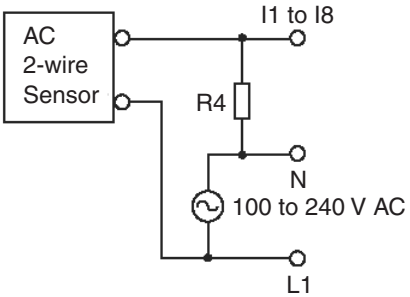


FL1B-M08C2R2

Digital AC/DC Input



When using the AC two-wire sensor



Note : Bleeder resistance (R4) calculation

R4 must satisfy the following three conditions.

Condition 1: $R4\ (\Omega) \leq \dfrac{\text{Maximum input OFF voltage (= 40V AC)}}{\text{Maximum sensor leakage current (A)}}$

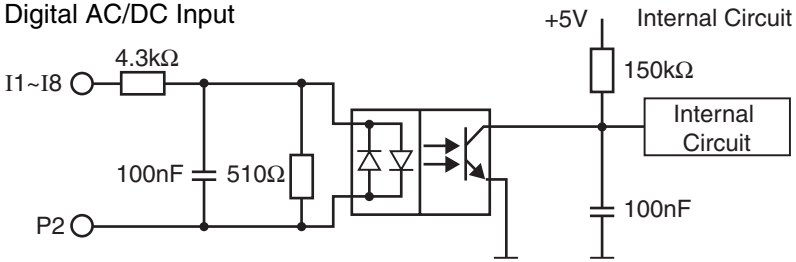
Condition 2: $R4\ (\Omega) \leq \dfrac{\text{Sensor power voltage (V)}}{\text{Minimum sensor load current (A)}}$

The voltage drop across the load (R4) must be less than 40V while the sensor is turned off.

Condition 3: $P_{R4}\ (W) \geq \dfrac{\{\text{Sensor power voltage (V)}\}^2}{\text{R4 resistance } (\Omega)} \times 3$ (3: recommended allowance)

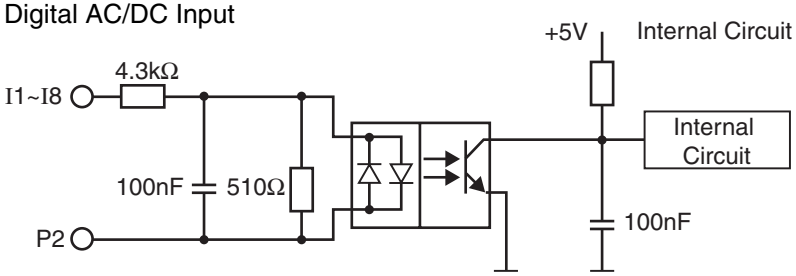
FL1E-H12RCA / FL1E-B12RCA

Digital AC/DC Input

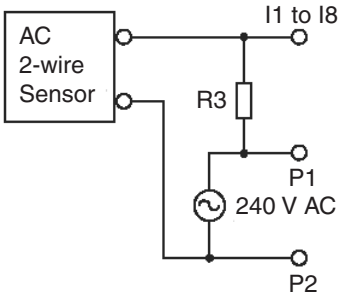


FL1B-M08D2R2

Digital AC/DC Input



When using the AC two-wire sensor



Note : Bleeder resistance (R3) calculation

R3 must satisfy the following three conditions.

Condition 1: $R3\ (\Omega) \leq \dfrac{\text{Maximum input OFF voltage (= 5V AC)}}{\text{Maximum sensor leakage current (A)}}$

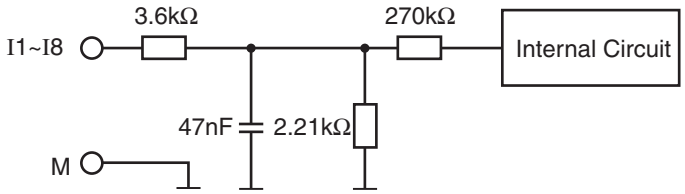
Condition 2: $R3\ (\Omega) \leq \dfrac{\text{Sensor power voltage (V)}}{\text{Minimum sensor load current (A)}}$

The voltage drop across the load (R3) must be less than 5V while the sensor is turned off.

Condition 3: $P_{R3}\ (W) \geq \dfrac{\{\text{Sensor power voltage (V)}\}^2}{\text{R3 resistance } (\Omega)} \times 3$ (3: recommended allowance)

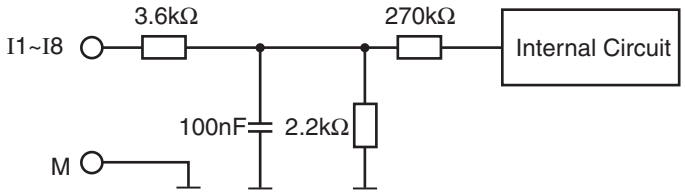
FL1E-H12RCE / FL1E-B12RCE / FL1E-H12SND

Digital DC Input



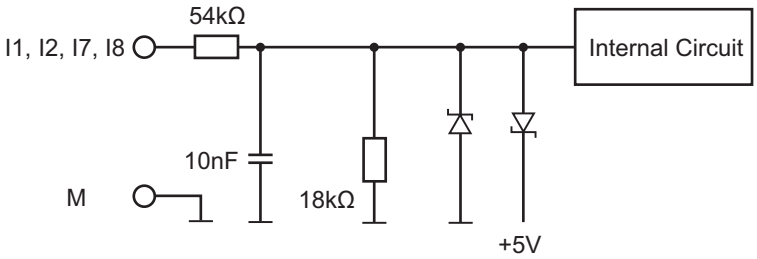
FL1B-M08B2R2/FL1B-M08B1S2

Digital DC Input



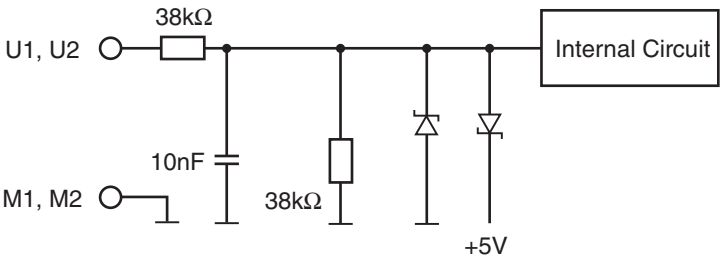
FL1E-H12RCE / FL1E-B12RCE / FL1E-H12SND

Analog Input (0-10V)



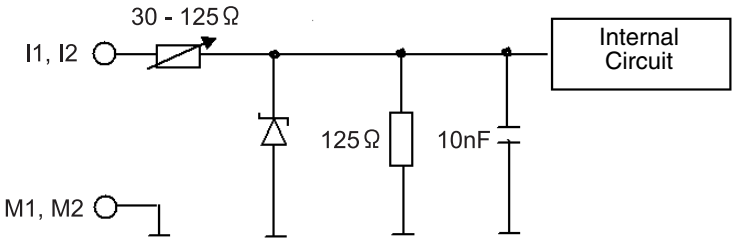
FL1B-J2B2

Analog Input (0-10V)



FL1B-J2B2

Analog Input (0-20mA)



Note

Fluctuating analog values are due to screening on the connecting wire from the analog valuator device to the analog FL1B-J2B2 expansion module (encoder wire) that has either been mounted incorrectly or not at all.
To avoid fluctuating analog values when using these expansion modules, proceed as follows:

- Use only shielded encoder wires.
- Shorten the encoder wire as much as possible. The encoder wire must not be more than 10 meters long.
- Clamp the encoder wire on one side only and clamp it only to the PE terminal on the FL1B-J2B2 / FL1D-K2B2 / FL1D-K2BM2 expansion module.
- Connect ground on the encoder supply to the PE terminal on the expansion module.

2.3.4 Connecting outputs

FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCC / FL1E-B12RCC / FL1E-H12RCE / FL1E-B12RCE

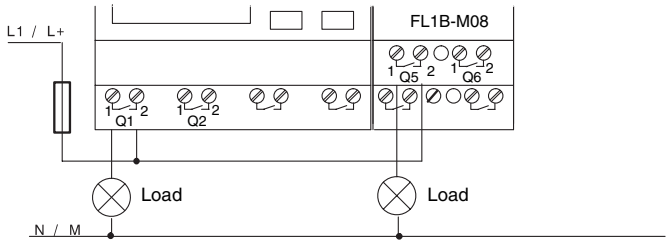
The FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCC / FL1E-B12RCC / FL1E-H12RCE / FL1E-B12RCE version is equipped with relay outputs. The potential of the relay contacts is isolated from the power supply and the inputs.

Requirements for relay outputs

You can connect various loads to the outputs, e.g. lamps, fluorescent lamps, motors, contactor relays etc. For information on the properties required for the loads connected to FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCC / FL1E-B12RCC / FL1E-H12RCE / FL1E-B12RCE, refer to Appendix A.

Connecting

This is how you connect the load to FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCC / FL1E-B12RCC / FL1E-H12RCE / FL1E-B12RCE:



Protection with automatic circuit-breaker, max. 16 A, characteristics B16, e.g.: Power circuit-breaker 5SX2 116-6 (if required)

IDEC SmartRelay with transistor outputs

IDEC SmartRelay versions with transistor outputs can be identified by the fact that the letter **R** is missing from their type name. The outputs are short circuit-proof and overload-proof. An auxiliary load voltage supply is not necessary, because IDEC SmartRelay supplies the load voltage.

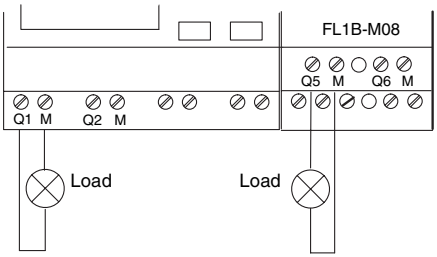
Requirements for transistor outputs

The load connected to IDEC SmartRelay must have the following characteristics:

- The maximum switched current is 0.3 A per output.

Connecting

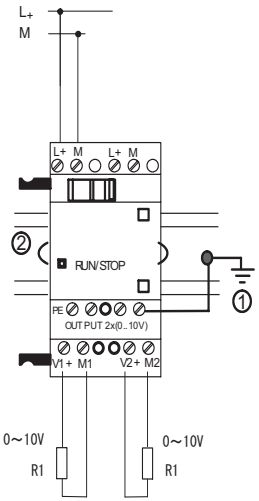
This is how you connect the load to an IDEC SmartRelay with transistor outputs:



Load: 24 V DC, 0.3 A max.

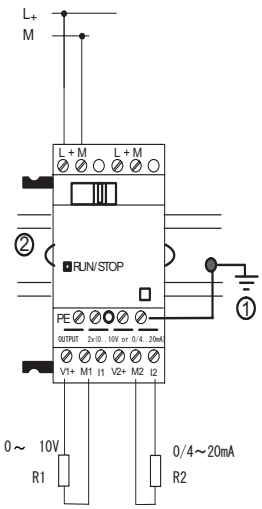
FL1D-K2B2 / FL1D-K2BM2

FL1D-K2B2



V1, V2: 0 - 10 V DC

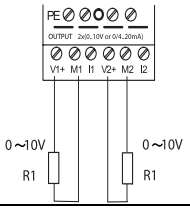
FL1D-K2BM2



V1, V2: 0 - 10 V DC
R1: >= 5 kΩ
I1, I2: 0/4 - 20 mA
R2: <= 250Ω

The terminal arrangement on the FL1D-K2BM2 is different from that of the FL1D-K2B2.
Check the analog output terminals on the FL1D-K2BM2, and replace the FL1D-K2B2 with the FL1D-K2BM2.

FL1D-K2BM2: Voltage output:



Note

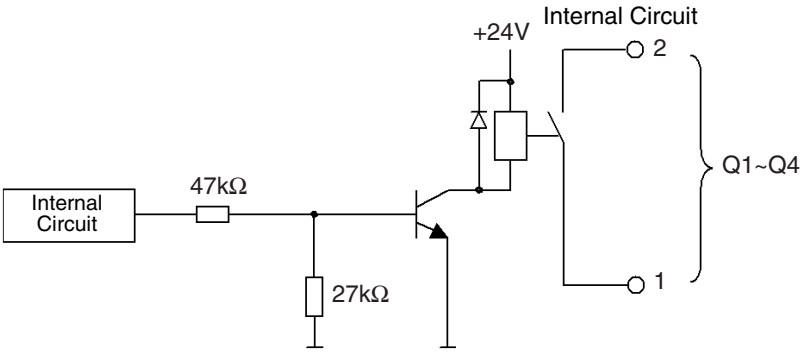
Caution for wiring the analog output terminals:

Check the analog output terminals, and wire each output terminal to the external equipment, according to the type of analog outputs.Incorrect wiring may cause damage to the equipment connected to the analog output terminals.

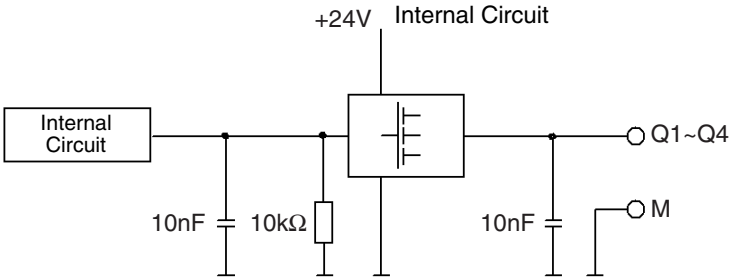
The terminal arrangement on the FL1D-K2BM2 is different from that of the FL1D-K2B2. Check the analog output terminals on the FL1D-K2BM2, and replace the FL1D-K2B2 with the FL1D-K2BM2.

Output Internal Circuit

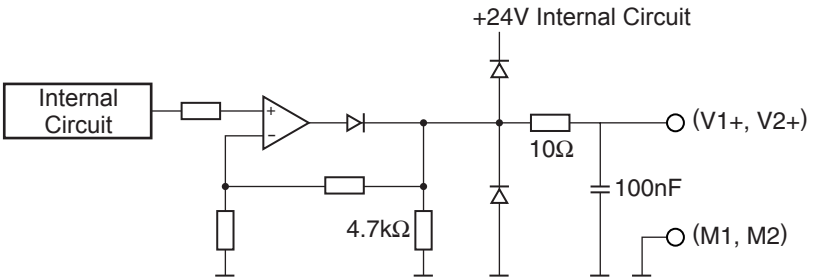
FL1E-H12RCA / FL1E-B12RCA / FL1E-H12RCC / FL1E-B12RCC / FL1E-H12RCE / FL1E-B12RCE / FL1B-M08B2R2 / FL1B-M08C2R2 / FL1B-M08D2R2
Relay Output



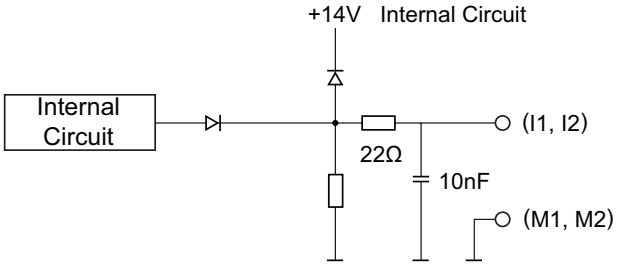
FL1E-H12SND / FL1B-M08B1S2
Transister Output (Source)



FL1D-K2B2 / FL1D-K2BM2
Analog Output (0-10V)



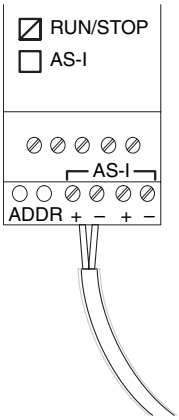
FL1D-K2BM2
Analog Output (0/4 ... 20mA)



2.3.5 Connecting the AS interface bus

To set the address of the module on the AS interface bus, you need an addressing unit.
Valid addresses are in the range of 1 to 31. Use each address once only.

You can set the address on the AS interface bus before or after installation.
If the installed module is addressed via the address socket, the AS-Interface voltage must be disconnected beforehand. This is necessary for safety reasons.



Networking on the AS interface bus

To make the connection to the AS interface bus, you need a communications-capable IDEC SmartRelay variant:

- IDEC SmartRelay base module + CM AS-I.

To be able to send data across the AS interface bus to IDEC SmartRelay and to receive data from it in the same way, you also need:

- an AS interface power supply and
- an AS interface master.

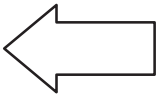
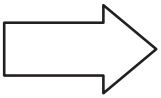
IDEC SmartRelay can only be accepted as a slave on the AS interface bus. This means that it is not possible to directly exchange data between two IDEC SmartRelay devices. Data is always exchanged across the AS interface master.

Warning

The AS-Interface and IDEC SmartRelay systems must **never** be connected together electrically!

Use safe isolation acc. to IEC 61131-2, EN 50178, UL 508, CSA C22.2 No. 42.

Logic Assignments

IDEC SmartRelay system		AS Interface system
Inputs		**Output data bits**
I_n		DQ1
I_{n+1}		DQ2
I_{n+2}		DQ3
I_{n+3}		DQ4
Outputs		**Input data bits**
Q_n		DI1
Q_{n+1}		DI2
Q_{n+2}		DI3
Q_{n+3}		DI4

”n” depends on the plug–in position of the expansion module relative to the IDEC SmartRelay base module. It indicates the number of the input or output in IDEC SmartRelay program code.

Note

Ensure that there is enough space for the inputs/outputs of the AS interface in the IDEC SmartRelay’s address space. If you are already using more than 12 physical outputs or more than 20 physical inputs, it is no longer possible to operate the CM AS interface!

2.4 Putting into operation

2.4.1 Switching on the IDEC SmartRelay/Power On

IDEC SmartRelay does not have a power switch. The reaction of IDEC SmartRelay during startup depends on the following:

- Whether a circuit program is stored in IDEC SmartRelay
- Whether a memory cartridge or combined memory/ battery cartridge is inserted
- Whether this is an IDEC SmartRelay version without display unit (FL1E-B12...)
- The status of IDEC SmartRelay at the time of power failure.

All possible reactions of IDEC SmartRelay are described on the following page.

To ensure that the expansion module on IDEC SmartRelay changes to RUN mode, check the following:

- Has the sliding contact between IDEC SmartRelay and the expansion module snapped into place properly?
- Is the power supply connected to the expansion module?
- In addition, always ensure that you switch on the power supply to the expansion module first before activating the power supply to the IDEC SmartRelay base module (or activate both power supplies at the same time); if you do not do this, the system does not detect the expansion module when you start up the IDEC SmartRelay base module.

Note

After power-up, the FL1E performs initialization. After completing initialization, the FL1E is ready to start to run. During initialization, a sandglass is displayed on the CPU module with display, or the LED is lit red on the CPU module without display.

Initialization time (regardless of expansion module)

When a memory cartridge or a combined memory/battery cartridge is installed: Max. 10 sec

When a cartridge is not installed or when a battery cartridge is installed: Max. 9 sec

*The initialization time depends on the program size.

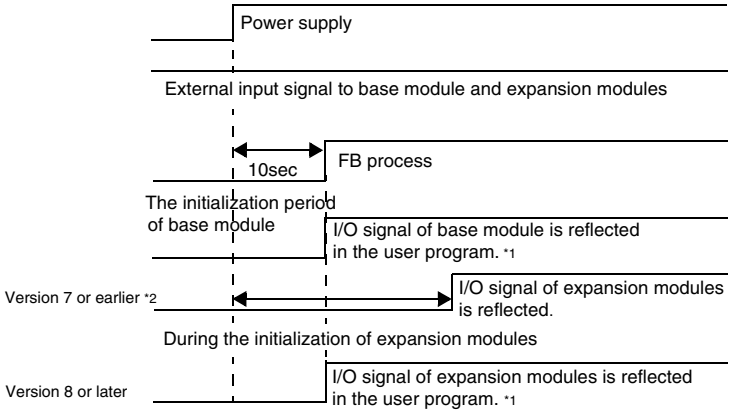
Notes for Using Expansion I/O Modules of Version 7 or earlier

When using 3 or more expansion I/O modules including those of the versions listed below, immediately after power-up, it takes a specific period of time for the base module to accept input signals from the expansion I/O modules. Until the output terminals on the expansion I/O module are actually turned on or off.

Expansion I/O Modules

FL1B-M08C2R2(Version 1 to 7),
FL1B-M08B1S2(Version 1 to 7),
FL1B-M08B2R2(Version 1 to 7),
FL1B-M08D2R2(Version 1 to 7),
FL1B-J2B2(Version 1 to 7),
FL1D-K2B2(Version 1)

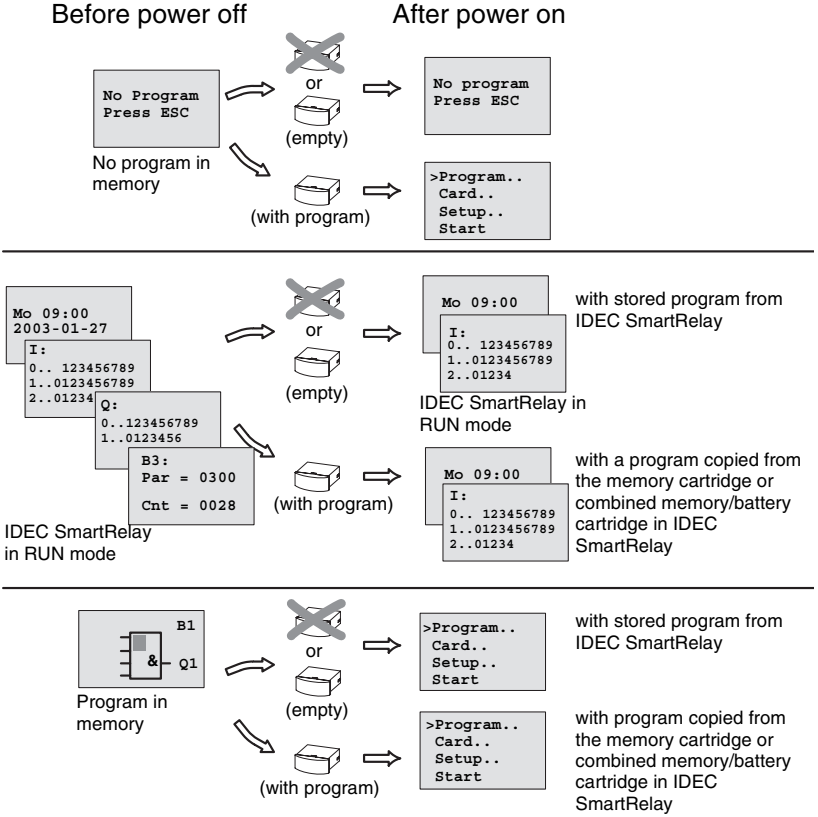
For identifying the version, see page 5.


Power supply
External input signal to base module and expansion modules
10sec
FB process
The initialization period of base module
I/O signal of base module is reflected in the user program. *1
Version 7 or earlier *2
I/O signal of expansion modules is reflected.
During the initialization of expansion modules
Version 8 or later
I/O signal of expansion modules is reflected in the user program. *1

*1 Output signal of base module and expansion modules are reflected 1 scan time after each input signal has been reflected.

*2 During the initialization period of expansion I/O modules, inputs and outputs are off. In addition, the length of initialization period varies with expansion I/O modules , and I/O response depends on the expansion I/O modules.

For further information, see our Internet address (URL: http://www.idec.com/faq/en/controller/).



You can also memorize four simple rules for starting IDEC SmartRelay :

1. If neither IDEC SmartRelay nor the inserted memory cartridge or combined memory/battery cartridge contains a circuit program, IDEC SmartRelay (with display unit) reports: 'No Program / Press ESC'.
2. A circuit program on the memory cartridge or combined memory/battery cartridge is automatically copied to IDEC SmartRelay. The circuit program in IDEC SmartRelay is overwritten.
3. If there is a circuit program in IDEC SmartRelay or on the memory cartridge or combined memory/battery cartridge, IDEC SmartRelay adopts the operational state it had prior to POWER-OFF. Versions without display unit (FL1E-B12...) automatically change from STOP to RUN (LED changes from red to green).

4. If you have enabled retentivity for at least one function, or a function is permanently retentive, the current values are retained at POWER-OFF.

Note

When a power failure occurs while you are entering a circuit program, the program in IDEC SmartRelay will be deleted after power is returned.

Before you modify the circuit program, save a backup copy of your original to a memory cartridge, a combined memory/battery cartridge or to a computer (WindLGC).

2.4.2 Operating states

IDEC SmartRelay base module operating states

IDEC SmartRelay base module/Pure knows has two operating states: STOP and RUN.

STOP	RUN
• The display shows: 'No Program' (not FL1E-B12...) • Switching IDEC SmartRelay to programming mode (not FL1E-B12...) • LED is red (only FL1E-B12...)	• Display: Screen mask for monitoring I/Os and messages (after START in the main menu) (not FL1E-B12...) • Switching IDEC SmartRelay to parameter assignment mode (not FL1E-B12...) • LED is green (only FL1E-B12...)
Action of IDEC SmartRelay: • The input data is not read. • The circuit program is not executed. • The relay contacts are permanently open or the transistor outputs are switched off.	Action of IDEC SmartRelay: • IDEC SmartRelay reads the status of the inputs. • IDEC SmartRelay uses the circuit program to calculate the status of the outputs. • IDEC SmartRelay switches the relay/transistor outputs on or off.

Note

After switching the power on, the system briefly switches through the outputs on the FL1E-H12SND. With an open circuit, a voltage of > 8 V can occur for up to approximately 100 ms; when loaded, this time reduces to a matter of microseconds.

IDEC SmartRelay expansion modules, operating states

IDEC SmartRelay expansion modules have three operating states: The LED (RUN/STOP) is lit green, red or orange.

LED (RUN/STOP) is lit		
Green (RUN)	**Red (STOP)**	**Orange/Yellow**
The expansion module communicates with the device to the left.	The expansion module does **not** communicate with the device to its left.	Initialization phase of the expansion module

CM AS Interface, communication states

The CM AS Interface has three communication states: The LED is lit green, red or flashes red/yellow.

LED AS-I is lit		
Green	**Red**	**Red/Yellow**
AS Interface communication OK	AS Interface communication failed	Slave has address ”0”.

CM AS Interface, behavior on communication failure

- If the AS Interface voltage fails, communication between the IDEC SmartRelay system and the expansion modules, which are arranged to the right of the IDEC SmartRelay CM AS Interface expansion module, is interrupted.
  Recommendation: Position IDEC SmartRelay CM AS Interface on the far right side.
- If communication is interrupted, the switching outputs are reset after about 40 to 100 ms.

Programming IDEC SmartRelay 3

Getting started with IDEC SmartRelay

Programming refers to creating a circuit program from the IDEC SmartRelay base module.

In this chapter you will learn how to use IDEC SmartRelay to create the IDEC SmartRelay circuit programs for your application.

WindLGC is the IDEC SmartRelay programming software that you can use on your PC to quickly and easily create, test, modify save and print the circuit programs. The topics in this manual, however, relate only to the creation of circuit programs on the actual IDEC SmartRelay base module. The programming software WindLGC contains extensive online help. See also Chapter 7 for additional information.

Note

IDEC SmartRelay versions without a display unit; that is, the FL1E-B12RCE, FL1E-B12RCA and FL1E-B12RCC versions, do not have an operator panel and display unit. They are primarily designed for use in small machine and process equipment engineering systems for series production.

FL1E-B12... versions are not programmed directly on the device. Instead, the circuit program is downloaded to the device from WindLGC or from memory cartridges or combined memory/battery cartridges from other IDEC SmartRelay devices.

IDEC SmartRelay versions without a display cannot write data to memory cartridges or combined memory/battery cartridges.

See Chapters 6, 7 and Appendix C.

A small example in the first part of this chapter introduces the operating principles of IDEC SmartRelay:

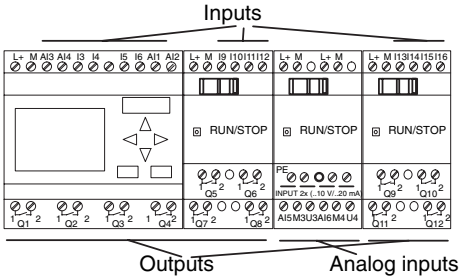
- You will learn the meaning of two basic terms, namely the **connector** and the **block**.
- As the next step, you will create a circuit program based on a simple conventional circuit.
- Lastly, you will enter this program directly in IDEC SmartRelay.

It will take you only a few pages of this manual to store your first executable circuit program in the IDEC SmartRelay unit. With suitable hardware (switches etc.), you will then be able to carry out initial tests.

3.1 Connectors

IDEC SmartRelay is equipped with inputs and outputs

Example of a configuration with several modules:



Each input is identified by the letter I plus a number. When you look at IDEC SmartRelay from the front, you can see the input terminals at the top. Only analog modules FL1B-J2B2 have the inputs at the bottom.
Each output is identified by the letter Q plus a number (FL1D-K2B2, FL1D-K2BM2: AQ plus number). In the figure, you can see the output terminals at the bottom.

Note

IDEC SmartRelay can recognize, read and switch the I/O of all expansion modules regardless of their type. The I/Os are presented in the installation order of the modules.
The following I/Os and marker blocks are available for creating your circuit program: : I1 to I24, AI1 to AI8, Q1 to Q16, AQ1 and AQ2, M1 to M27 and AM1 to AM6. Also available are the shift register bits S1 to S8, 4 cursor keys: C ▲, C ▶, C ▼ and C ◀, four function keys on the Text Display: F1, F2, F3, and F4 as well as 16 blank outputs X1 to X16. See Chapter 4.1 for more details.
The following applies to inputs I1, I2, I7 and I8 of FL1E-H12RCE/ FL1E-B12RCE and FL1E-H12SND versions: If you use I1, I2, I7 or I8 in the circuit program, this input signal is digital. If you use AI3, AI4, AI1, or AI2, the input signal is analog. The numbering of the analog inputs is significant: AI1 and AI2 corresponded to I7 and I8 on the FL1D module. With the addition of two new analog inputs for the FL1E series, these modules optionally use I1 for AI3 and I2 for AI4. See the graphical representation at 2.1.1. Also note that you can also use I3, I4, I5, and I6 as fast digital inputs.

The illustration above with numbered AI inputs shows the conceptual usage of the inputs, not the actual physical markings on the module.

IDEC SmartRelay's connectors

The term connector refers to all connections and states in IDEC SmartRelay.

The digital I/O status can be '0' or '1'. Status '0' means that the input does not carry a specific voltage. Status '1' means that the input does carry a specific voltage.

The 'hi', 'lo' and 'x' connectors have been introduced to make it easier for you to create the circuit program:
'hi' (high) is assigned the status '1',
'lo' (low) is assigned the status '0'.

You do not have to use all of the connectors of a block. The circuit program automatically assigns the unused connectors a status that ensures proper functioning of the relevant block. If you prefer to do so, you can identify unused connectors with an 'x'.

For information on the meaning of the term "block", refer to Chapter 3.2.

IDEC SmartRelay has the following connectors:

Connectors	**IDEC SmartRelay base module**		**DM**	**AI**	**AO**
Inputs	FL1E-H12RCC/ FL1E-B12RCC, FL1E-H12RCA/ FL1E-B12RCA	Two groups: I1... I4 and I5 ... I8	I9 ... I24	AI1... AI8	none
	FL1E-H12RCE/ FL1E-B12RCE, FL1E-H12SND	I1,I2,I3-I6,I7,I8 AI3,AI4 ...AI1, AI2	I9 ... I24	AI5... AI8	
Outputs	Q1...Q4		Q5 ... Q16	none	AQ1, AQ2
lo	Logical '0' signals (off)				
hi	Logical '1' signals (on)				
x	An existing connection that is not used				

DM: Digital module
AI: Analog input module
AO: Analog output module

3.2 Blocks and block numbers

This chapter shows you how to use IDEC SmartRelay elements to create complex circuits and how blocks and I/O are interconnected.

In Chapter 3.3 you will learn how to transform a conventional circuit into an IDEC SmartRelay circuit program.

Blocks

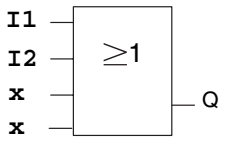
A block in IDEC SmartRelay represents a function that is used to convert input information into output information. Previously you had to wire the individual elements in a control cabinet or terminal box.

When you create the circuit program, you interconnect the blocks. To do so, simply select the connection you require from the **Co** menu. The menu name Co is an abbreviation of the term “Connector”.

Logic operations

The most elementary blocks are the logic operations:

- AND
- OR
- ...



Inputs I1 and I2 are here connected to the OR block. The last two inputs of the block remain unused and are identified by the creator of the circuit program with an ‘x’.

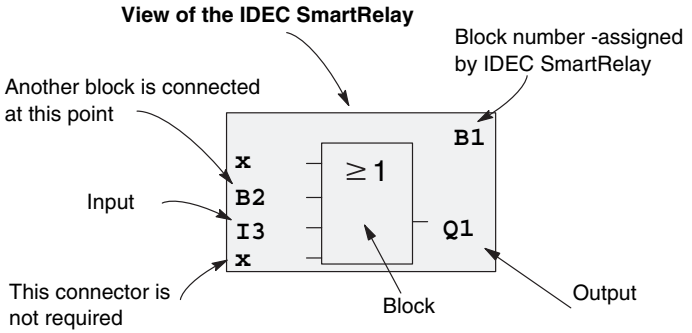
These special functions offer you significantly greater performance:

- Current impulse relay
- Up/down counter
- On-delay
- Softkey
- ...

Chapter 4 gives a full list of the IDEC SmartRelay functions.

Block representation on the IDEC SmartRelay display

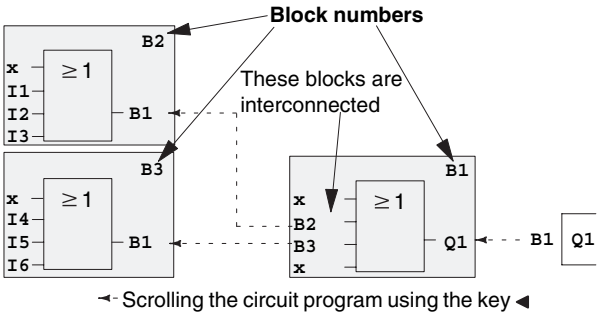
The figure below shows a typical view of the IDEC SmartRelay display. As you can see, it can show only one block at a time. We have therefore introduced block numbers to help you check the circuit structure.



Assigning a block number

IDEC SmartRelay assigns each new block in a circuit program a block number.

IDEC SmartRelay uses these block numbers to indicate the block interconnections. This means that these numbers are mainly an aid to your orientation in the circuit program.



The figure above shows you three views of the IDEC SmartRelay display, which represent the circuit program. As you can see, IDEC SmartRelay interconnects the blocks using their numbers.

Advantages of block numbers

You can connect almost any block to an input of the current block by means of its block number. In this way, you can reuse the interim results of logical or other operations, reduce programming effort, save memory space and clean up your circuit layout. To do so, however, you need to know how IDEC SmartRelay has named the blocks.

Note

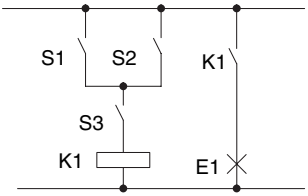
We advise you to create an organizational program chart. You will find this a valuable aid when you create the circuit program because you can enter in this chart all the block numbers that IDEC SmartRelay assigns.

By using the WindLGC software to program IDEC SmartRelay, you can directly create a function chart of your circuit program. WindLGC also allows you to assign eight-character names to up to 100 blocks, and to view these on the IDEC SmartRelay display in parameter assignment mode (see Chapter 3.4).

3.3 From circuit diagram to IDEC SmartRelay program

View of a circuit diagram

You know, of course, how a circuit logic is represented in a circuit diagram. Nevertheless, here is an example:

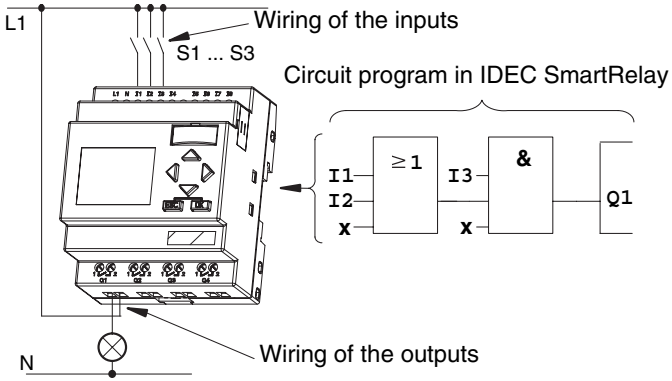


Load E1 is switched on and off by means of the switches (S1 **OR** S2) **AND** S3.

Relay K1 picks up when condition (S1 OR S2) AND S3 is met.

Creating this circuit with IDEC SmartRelay

In IDEC SmartRelay you create a circuit logic by interconnecting blocks and connectors:

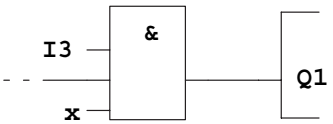


Note

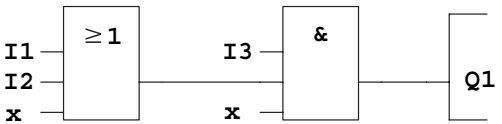
Although you have four inputs available for logic operations (Basic functions, see Chapter 4.2), most of the views will only show three inputs for reasons of clarity. You program this fourth input and assign parameters just like you do with the other three inputs.

To create a circuit logic in IDEC SmartRelay, start at the circuit output.
The output is the load or relay that is to be switched.
Convert the circuit logic into blocks by working through the circuit, starting at the output and ending at the input:

Step 1: The Normally Open Contact S3 is interconnected in series to output Q1 and to a further circuit element. A series connection corresponds with the AND block:



Step 2: S1 and S2 are connected in parallel. A parallel circuit corresponds with the OR block:



Unused inputs

The circuit program automatically assigns the unused connectors a status that ensures proper functioning of the relevant block. If you like, you can label unused connectors with an 'x' identifier.
In our example we shall use only two inputs of the OR block and two inputs of the AND block; the relevant unused third and fourth inputs are identified at the connector with an 'x'.
Now connect the I/Os to IDEC SmartRelay.

Wiring

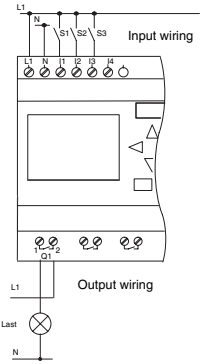
Connect the switches S1 to S3 to the screw terminals of your IDEC SmartRelay :

- S1 to connector I1 of IDEC SmartRelay
- S2 to connector I2 of IDEC SmartRelay
- S3 to connector I3 of IDEC SmartRelay

The output of the AND block controls the relay at output Q1.
The load E1 is connected to output Q1.

Wiring example

The following figure shows you the wiring, based on a 230 V AC version of IDEC SmartRelay.



3.4 The four golden rules for operating IDEC SmartRelay

Rule 1

Changing the operating mode

- You create the circuit program in **programming mode**. After power is on, and when the display shows “No Program / Press ESC”, press the **ESC** key to select programming mode.
- Timer and parameter values of an existing circuit program can be edited both in **parameter assignment mode** and in **programming mode**. During **parameter assignment** IDEC SmartRelay is in **RUN mode**; that is, it continues executing the circuit program (see Chapter 5). To work in **programming mode,** you need to terminate the circuit program by calling the **“Stop”** command.
- Select the ’Start’ command on the main menu to set **RUN mode**.
- When the system is in **RUN**, you can return to **parameter assignment mode** by pressing the **ESC** key.
- When **parameter assignment mode** is open and you want to return to **programming mode**, select the **“Stop”** command from the parameter assignment menu, and confirm **“Stop Prg”** prompt with **“Yes”**. To do so, move the cursor to “**Yes**” and confirm with OK.

For more details on operating modes, refer to Appendix D.

Rule 2

Outputs and inputs

- Always create your circuit program by working from the output to the input.
- You can connect an output to several inputs, but not the same input to several outputs.
- Within the same program path you may not connect an output to an upstream input. For such internal recursions you should interconnect memory markers or outputs.

Rule 3

Cursor and cursor movement

The following applies when you edit a circuit program:

- You can **move the cursor** when it appears in the form of an underscore:
  - Press ◀, ▶, ▼ or ▲ to move the cursor in the circuit program.
  - Press **OK** to change to ”Select connector/block”.
  - Press **ESC** to exit programming mode.
- You **select a connector/block**

when the cursor appears as a solid square

- Press ▼ or ▲ to select a connector or a block.
- Confirm with OK.
- Press **ESC** to return to the previous step.

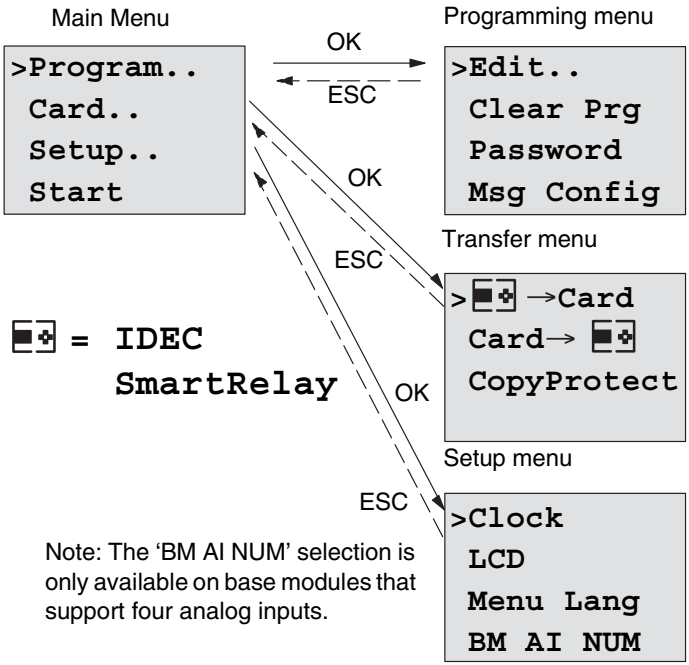
Rule 4

Planning

- Before you start to create a circuit program, you should either first create a design on paper or program IDEC SmartRelay directly using WindLGC.
- IDEC SmartRelay can only save complete and faultless circuit programs.

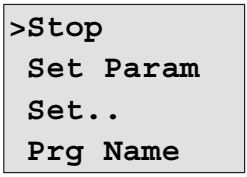
3.5 Overview of IDEC SmartRelay menus

Programming mode



Parameter assignment mode

Parameter assignment menu



For more details on these menus, refer to Appendix D.

The Text Display menus provide configuration settings for the Text Display. These menus are a subset of the IDEC SmartRelay menus and are operated in much the same way. Appendix section D.2 shows the Text Display menus.

3.6 Writing and starting the circuit program

After you have designed a circuit, you want to write it to your IDEC SmartRelay. The small example below shows how to do this.

3.6.1 Selecting programming mode

You have connected IDEC SmartRelay to the power supply and switched it on. The display now shows you the message:

```
No Program
Press ESC
```

Switch IDEC SmartRelay to programming mode by pressing **ESC**. This will take you to the main menu of IDEC SmartRelay:

```
>Program..
 Card..
 Setup..
 Start
```

IDEC SmartRelay's main menu

The first character in the first line is the ">" cursor. Press ▲ and ▼ to move the ">" cursor up and down. Move it to "Program.." and confirm with **OK**. IDEC SmartRelay opens the programming menu.

```
>Edit..
 Clear Prg
 Password
 Msg Config
```

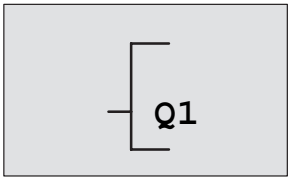
IDEC SmartRelay's programming menu

Here you can also move the ">" cursor by pressing ▲ and ▼. Move the ">" cursor to "**Edit..**" and confirm with **OK**.

```
>Edit Prg
 Edit Name
 AQ
 Memory?
```

The Edit menu of IDEC SmartRelay

Move the ”>” cursor to ”**Edit Prg**” (for editing the circuit program) and confirm with **OK**. IDEC SmartRelay now shows you the first output:



The first output of IDEC SmartRelay

You are now in programming mode. Press ▲ and ▼ to select the other outputs. Now start to edit your circuit program.

Note

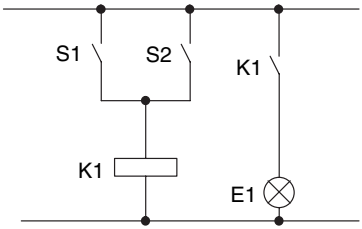
Because we have not yet saved a **password** for the circuit program in IDEC SmartRelay, you can directly enter editing mode. When you select “Edit” after you have saved a password-protected circuit program, you are prompted to enter a password and to confirm it with **OK**. You can only edit the program after you have entered the correct password (see Chapter 3.6.5.).

3.6.2 The first circuit program

Let us now take a look at the following parallel circuit consisting of two switches.

Circuit diagram

The corresponding circuit diagram:



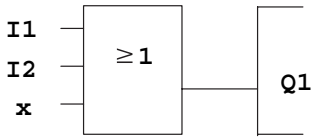
The load is switched on with S1 OR S2. IDEC SmartRelay interprets this parallel circuit as an ‘OR’ logic, because S1 **OR** S2 switches on the output.

Translated into an IDEC SmartRelay circuit program this means: Relay K1 is (at output Q1) is controlled by means of an OR block.

Circuit program

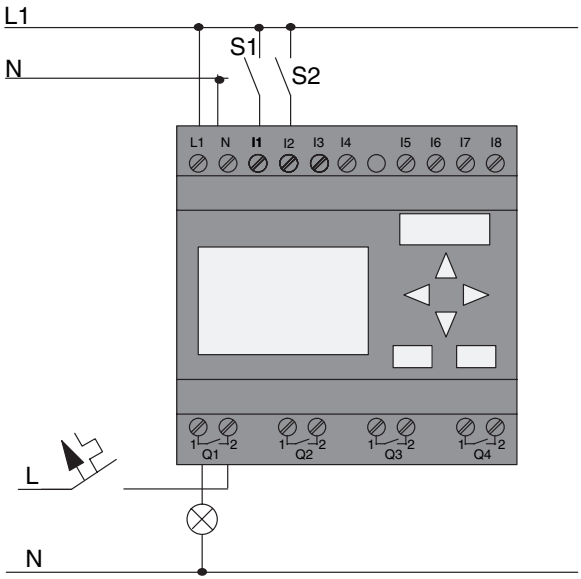
S1 is connected to the I1 and S2 to the I2 input connector of the OR block.

The corresponding layout of the circuit program in IDEC SmartRelay:



Wiring

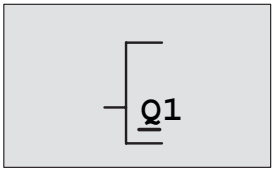
The corresponding wiring:



S1 switches input I1, while S2 switches input I2. The load is connected to the relay Q1.

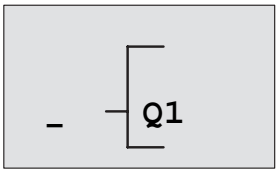
3.6.3 Circuit program input

Let us now write the circuit program, starting at the output and working towards the input. IDEC SmartRelay initially shows the output:



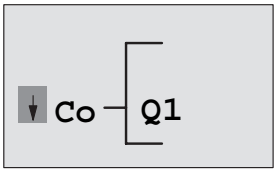
The first IDEC SmartRelay output

You will see an underscore below the Q in Q1, which is the **cursor**. The cursor indicates your current position in the circuit program. You can move the cursor by pressing the ▲ ▼, ◀, and ▶ keys. Now press the ◀ key. The cursor moves to the left.



The cursor indicates your current position in the circuit program.

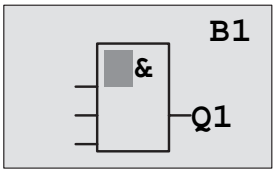
At this point you enter only the first (OR) block. Press **OK** to select editing mode.



The cursor is displayed as a solid square: You can now select a connector or a block

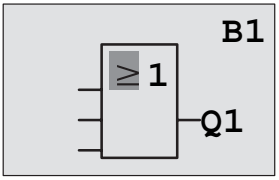
The cursor no longer appears in the form of an underscore; but instead as a flashing solid square. IDEC SmartRelay offers you various options here.

Select GF (basic functions) by pressing the ▼ key until GF appears, and confirm with **OK**. IDEC SmartRelay now shows the first block from the list of basic functions:



The AND is the first block of the basic functions list. The solid square cursor prompts you to select a block.

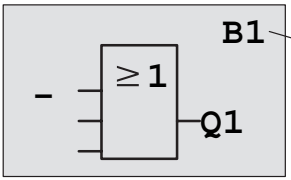
Now press ▼ or ▲ until the OR block appears on the display:



The solid square cursor is still positioned on the block.

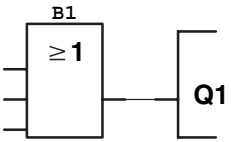
Press **OK** to confirm your entries and exit the dialog.

The display now shows:



Block number

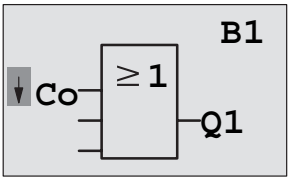
Your complete circuit program layout



You have now entered the first block. Each new block is automatically assigned a block number. The only thing left to do is interconnect the block inputs. This is how it is done:

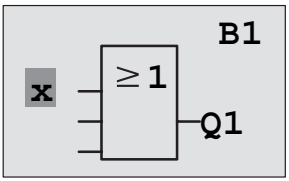
Press **OK**.

The display now shows:



Select the **Co** list: Press **OK**

The display now shows:

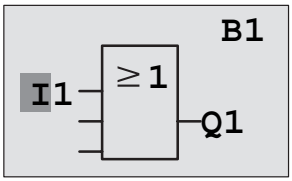


The first element of the **Co** list is the ”Input 1” character, namely ’**I1**’.

Note

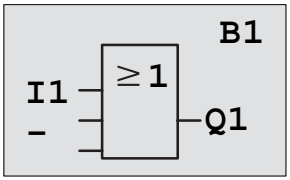
Press ▼ to go the start of the Co list: I1, I2 .... to Io. Press ▲ to go to the end of the Co list: Io, hi, ... to I1.

Inputs F1, F2, F3, and F4 are new as of the FL1E device series. They correspond to the four function keys on the optional Text Display.

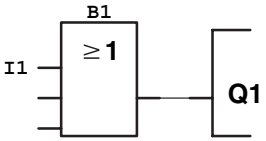


Press **OK**. I1 is now connected to the input of the OR block. The cursor jumps to the next input of the OR block.

The display now shows:



Your complete circuit program in IDEC SmartRelay up to now:

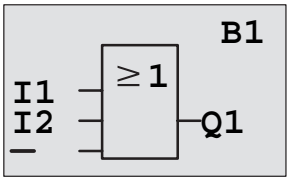


Now you connect input I2 to the input of the OR block. You already know how to do this:

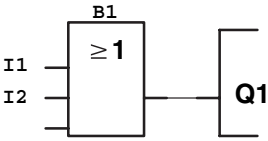
1. Switch to editing mode: Press **OK**
2. Select the **Co** list: Press ▼ or ▲
3. Confirm the Co list with: Press **OK**
4. Select **I2**: Press ▼ or ▲
5. Apply I2: Press **OK**

I2 is now connected to the input of the OR block:

The display now shows:



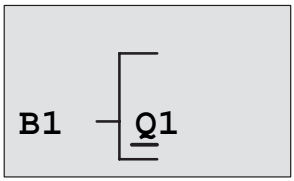
Your circuit program layout in IDEC SmartRelay up to now



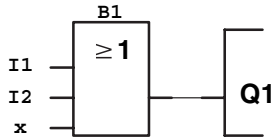
We do not need the last two inputs of the OR block for this circuit program. You can mark the unused inputs with an 'x'. Enter the 'x' character twice:

1. Switch to editing mode: Press **OK**
2. Select the **Co** list: Press ▼ or ▲
3. Accept the Co list: Press **OK**
4. Select '**x**': Press ▼ or ▲
5. Apply x: Press **OK**

The display now shows:



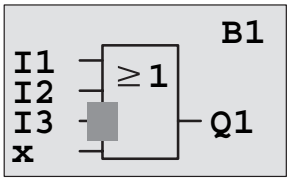
This is the layout of your circuit program



Note

You can invert individual inputs of the basic and special functions; that is, if an input carries a logical "1" signal, the circuit program will output a logical "0". On the other hand, a logical -0" is inverted into a logical "1" signal.

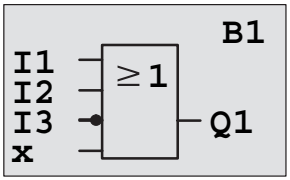
To invert an input, move the cursor to the relevant position, e.g.:



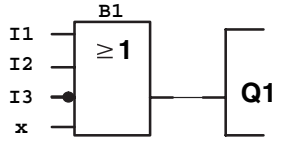
Confirm with **OK**.

Now press ▼ or ▲ to invert this input: –●

Next, press **ESC**.



Your circuit program layout



You can review your first circuit program by pressing ◀ or ▶ to move the cursor through the circuit program.

We shall now exit circuit programming mode. This is how it is done:

Return to the programming menu: Press **ESC**

Note

IDEC SmartRelay has now saved your circuit program to nonvolatile memory. The circuit program remains in the IDEC SmartRelay memory until you explicitly delete it.

You can save the actual values of special functions in the case of a power outage assuming that these functions support the “Retentive” parameter and that the necessary program memory is available. The Retentive parameter is deactivated when you insert a function; to use it, you must enable this option.

3.6.4 Assigning a circuit program name

You can assign your circuit program a name that consists of up to 16 uppercase/lowercase letters, numbers and special characters.
In the programming menu:

1. Move the “>” cursor to ’**Edit..**’: Press ▼ or ▲
2. Accept ’Edit’: Press **OK**
3. Move the “>” cursor to ’**Edit Name**’: Press ▼ or ▲
4. Accept ’Edit Name’: Press **OK**

Press ▼ and ▲ to list the alphabet, numbers and special characters, either in ascending or descending order. You can select any letter, number or character.
To enter a space character, simply move the cursor with ▶ to the next position. This character is the first one in the list.
Examples:

Press ▼ once to select an “ **A** ”
▲ four times to select “ **{** ”, etc.

The following character set is available:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	X	Y	Z	a	b	c	d	e
f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
v	w	x	y	z	0	1	2	3	4	5	6	7	8	9	!
”	#	$	%	&	’	(	)	*	+	,	-	.	/	:	;
<	=	>	?	@	[	\	]	^	_	‘	{	|	}	~	

Let us assume you want to name your circuit program “**ABC**”:

5. Select “ **A**”: Press ▼
6. Move to the next letter: Press ▶
7. Select “ **B**”: Press ▼
8. Move to the next letter: Press ▶
9. Select “ **C**”: Press ▼
10. Confirm the complete name: Press **OK**

Your circuit program is now named “**ABC**”, and you are returned to the programming menu.
To **change** the name of your circuit program, proceed in the same way.

Note

You can change the name of the circuit program only in programming mode. You can **read** the name both in programming **and** in parameter assignment mode.

3.6.5 Password

You can protect a circuit program from unauthorized access by assigning it a password.

You can only assign or deactivate a password from the IDEC SmartRelay Base module or from WindLGC. You can only change a password from the IDEC SmartRelay Base module. If you have assigned a password, and are using a Text Display (version 4 or later) together with an IDEC SmartRelay Base module (version 4 or later), you must enter this password if you want to change IDEC SmartRelay from RUN mode to STOP mode from the Text Display. You can not stop the execution of the circuit program in IDEC SmartRelay from the Text Display without entering the password.

Note

This additional password protection function is only available in the Text Display with version number 4 or later. This function is **only available** under the following conditions:

- The version number of both the IDEC SmartRelay Base and the Text Display installed is at least version 4
- IDEC SmartRelay is currently in RUN mode and you want to switch to STOP mode

There is only one password that you can assign for IDEC SmartRelay. You can only assign it from the IDEC SmartRelay base module or from WindLGC. To change IDEC SmartRelay from RUN to STOP from the Text Display, you must enter the password from the Text Display as described below in the section “Changing IDEC SmartRelay from RUN to STOP mode from the Text Display”.

Assigning a password from the IDEC SmartRelay Base module

A password can have a maximum length of 10 characters, and consists only of uppercase letters. On IDEC SmartRelay, the password can be assigned, edited or deactivated only in the “Password” menu.

To enter a password, follow these steps in the programming menu:

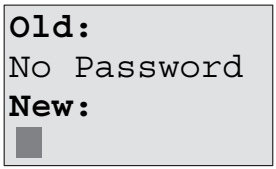
1. Move the “>” cursor to ’**Password**’: Press ▼ or ▲
2. Confirm the ’Password’: Press **OK**

Press ▼ or ▲ to move up and down the alphabet to select your letters. Because IDEC SmartRelay only provides

uppercase letters for the password, you can quickly access letters “at the end“ of the alphabet (in this example, English) by using the ▲ button:

Press ▲ once to select “**Z**”
Press ▲ twice to select “**Y**”, etc.

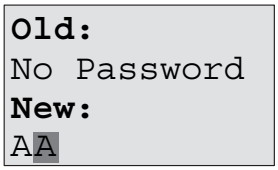
Let us assign the password “**AA**” to our first circuit program. The display now shows:



This procedure is the same as for entering the name of the circuit program. Select “New” and enter:

3. Select “ **A**”: Press ▼
4. Move to the next letter: Press ▶
5. Select “ **A**”: Press ▼

The display now shows:



6. Confirm the password: Press **OK**

Your circuit program is now protected with the password “**AA**”, and you are returned to the programming menu.

Note

You can cancel the input of a new password with **ESC**. In this case, IDEC SmartRelay returns to the programming menu without saving the password.

You can also set your password using WindLGC. You cannot edit a password-protected circuit program on IDEC SmartRelay or upload it to WindLGC unless you enter the correct password.

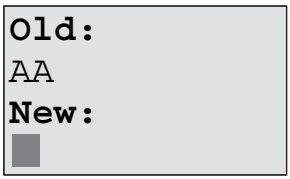
To allow you to create and edit a circuit program for a protected module (Card), you first need to assign a password to this new program (see Chapter 6.1).

Changing the password from the IDEC SmartRelay Base module

You must know the current password in order to change it.
In the programming menu:

1. Move the '>' cursor to '**Password**': Press ▼ or ▲
2. Confirm the 'Password': Press **OK**

Select "Old" and enter your old password (in our case: '**AA**') by repeating steps 3 through 6 as described earlier.
The display now shows:



Now you can select "New" to enter the new password, e.g. "**ZZ**":

3. Select "**Z**": Press ▲
4. Move to the next letter: Press ▶
5. Select "**Z**": Press ▲

The display now shows:

6. Confirm your new password: Press **OK**

Your new password "**ZZ**" is now set, and you are returned to the programming menu.

Deactivating the password from the IDEC SmartRelay Base module

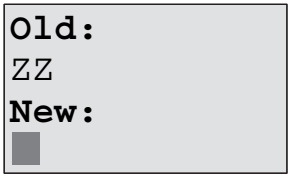
To deactivate the password to allow, for example, another user to edit your circuit program, you must know your current password (in our example "**ZZ**"), the same as if you were changing it.

To deactivate the password, following these steps in the programming menu:

1. Move the '>' cursor to '**Password**': Press ▼ or ▲
2. Confirm the 'Password': Press **OK**

Select "Old" and enter your current password as described in steps 3 to 5. Confirm your entries with **OK**.

The display shows:



Clear the password by leaving the input box **blank**:
3. Confirm the “blank” password: Press **OK**

The password is ”cleared”, and you are returned to the programming menu.

Note

This action disables the password prompt, and thus permits access without a password.

Let the password prompt be **deactivated** for the time being, in order to accelerate progress in our further exercises and examples.

Password: Wrong Password!

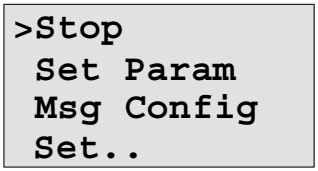
When the user inputs the **wrong** password and confirms the input with **OK**, IDEC SmartRelay does not open editing mode, but returns to the programming menu. This repeats itself over and again until you input the correct password.

Changing IDEC SmartRelay from RUN to STOP mode from the Text Display

A change from RUN mode to STOP mode from the Text Display requires password entry if one is assigned. You must know the existing password if one is assigned. If there is no password assigned on the IDEC SmartRelay Base module, the Text Display will not prompt you for password entry.

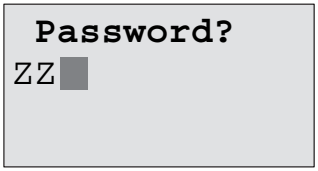
To change IDEC SmartRelay from RUN mode to STOP mode from the Text Display when IDEC SmartRelay is password-protected, follow these steps:

1. On the Text Display, press **ESC** to switch IDEC SmartRelay from RUN mode to STOP mode. Text Display shows the following menu:



2. Press **OK**. The Text Display shows you the following display:

3. Press ▼ to move the cursor to “Yes”, and press **OK**. Enter the correct password (in this case: “**ZZ**”). If you enter an incorrect password, the Text Display returns to the display in Step 1.



4. Press **OK** to exit the password entry screen form. The Text Display opens the main menu:

IDEC SmartRelay changes to STOP mode.

Note

Whenever the Text Display is initialized, the password needs to be inputted again. The next time you start it and access this password-protected function (RUN to STOP), you will be prompted for password entry on the Text Display.

When IDEC SmartRelay subsequently changes from STOP to RUN mode, you will again be prompted for password entry to change IDEC SmartRelay to STOP mode from the Text Display if more than one minute has elapsed since you pressed any key on the Text Display.

The Text Display can also change IDEC SmartRelay from STOP to RUN mode, but no password is required in this case.

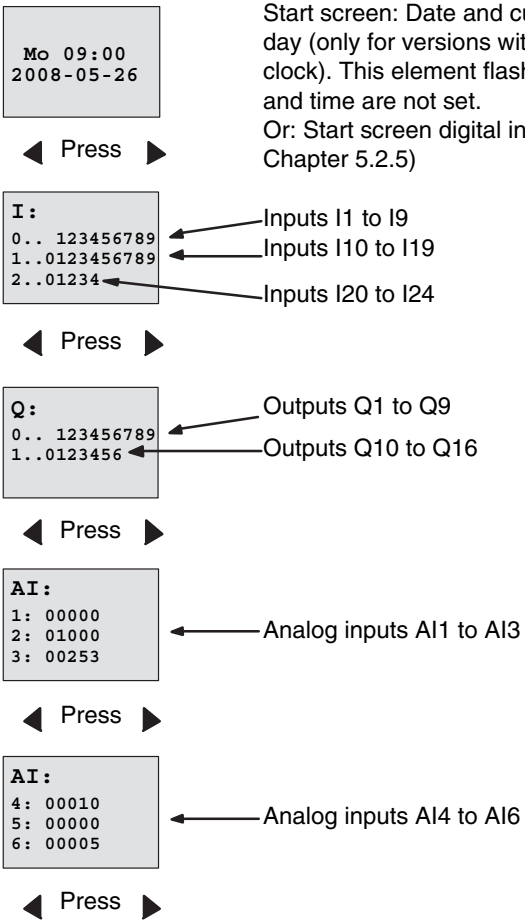
3.6.6 Switching IDEC SmartRelay to RUN mode

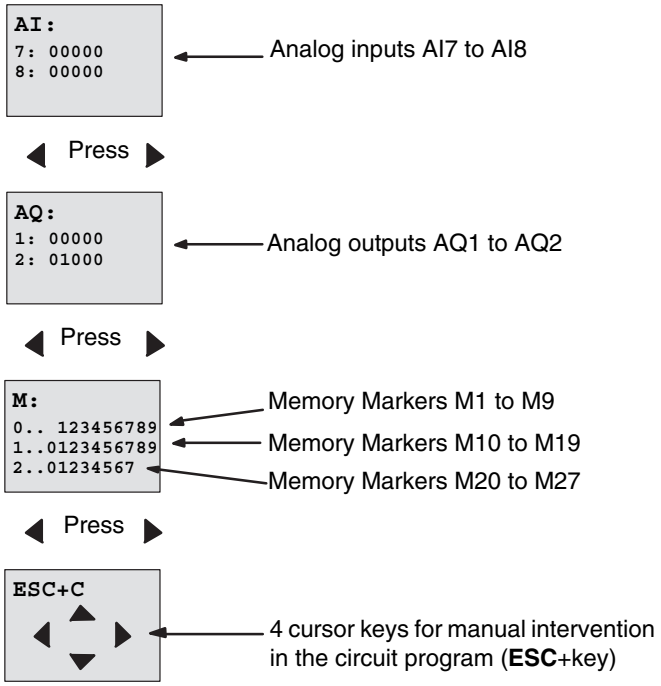
In the main menu, select RUN to start IDEC SmartRelay.

1. Return to the main menu: Press **ESC**
2. Move the '>' cursor to '**Start**': Press ▲ or ▼
3. Confirm 'Start': Press **OK**

IDEC SmartRelay runs the circuit program and shows the following display:

Display field of IDEC SmartRelay in RUN mode

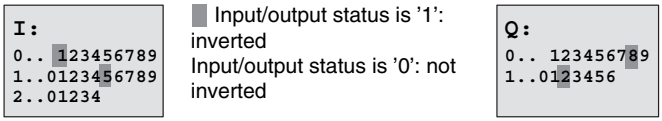




What is meant by: “IDEC SmartRelay is in RUN”?

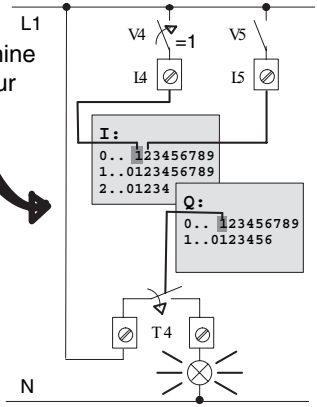
In RUN mode, IDEC SmartRelay executes the circuit program. To do so, IDEC SmartRelay first reads the status at the inputs, determines the status of the outputs by means of the user program, and switches these on or off according to your settings.

This is how IDEC SmartRelay indicates the I/O status:



In this example, only the inputs I1, I15, Q8 and Q12 are set “high”.

Status indication on the display



Let us examine this using our example:

When switch S1 is closed, the status at input I1 is hi. IDEC SmartRelay computes the output states by means of the circuit program.

Output Q1 = ‘1’, in this case.
When Q1 = ‘1’, IDEC SmartRelay sets relay Q1, and the load

3.6.7 Second circuit program

Up to this point, you have successfully created your first circuit and assigned it a name and, if desired, a password. In this section we will show you how to modify existing circuit programs and how to use the special functions.

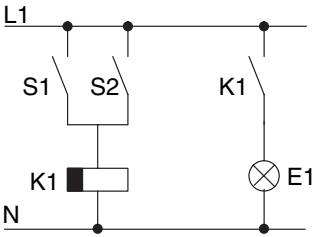
Using this second circuit program, we will show you how to:

- Add a block to an existing circuit program.
- Select a block for a special function.
- Assign parameters.

Modifying circuits

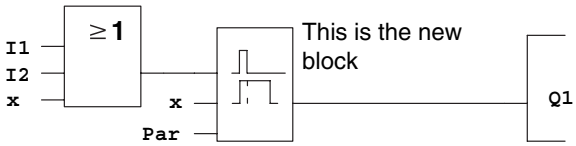
We shall use the first circuit program as a basis for the second, with some slight modifications.

First of all take a look at the circuit diagram for the second circuit program:



You already know the first part of the circuit. S1 and S2 switch a relay, which is to be used to switch on the load E1, and to switch off the load with a delay of 12 minutes.

This is the circuit program layout in IDEC SmartRelay:



You can see the OR block and the output relay Q1 we have already used in the first circuit program. The only difference is the new off-delay block.

Editing the circuit program

Switch IDEC SmartRelay to programming mode.

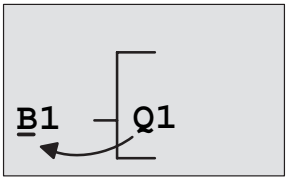
As a reminder:

1. Switch IDEC SmartRelay to programming mode (in RUN: Press **ESC** to enter the parameter assignment mode. Select the '**Stop**' command, confirm with **OK**, then move the '>' cursor to '**Yes**', and once again confirm with **OK**). See Page 66.
2. On the main menu, select "**Program**"
3. On the Programming menu, select "**Edit**", confirm with **OK**. Next, select "**Edit Prg**" and confirm with **OK**. If required, enter your password at the prompt and confirm with **OK**.

You can now modify the current circuit program.

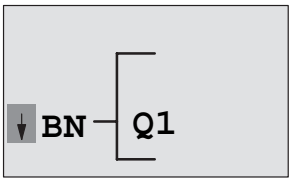
Adding a block to a circuit program

Move the cursor to the B in B1 (B1 is the number of the OR block):



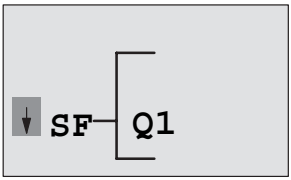
To move the cursor: Press ◀

We now insert the new block at this position.
Confirm with **OK**.



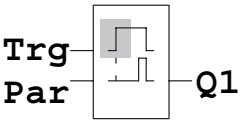
IDEC SmartRelay shows you the BN list

Press ▼ to select the SF list:



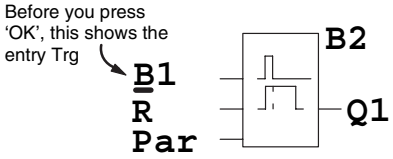
The SF list contains the special function blocks.

Press OK.
The block of the first special function is shown:



When you select a special or basic function block, IDEC SmartRelay shows you the relevant function block. The solid square cursor is positioned on the block. Press ▼ or ▲ to select the required block.

Select your block (off-delay, see the next figure), and then press **OK**:

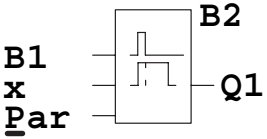


The added block is assigned the block number B2. The cursor is positioned at the top input of the added block.

The B1 block previously connected to Q1 is automatically connected to the uppermost input of the new block. Note that you can only interconnect digital inputs with digital outputs or analog inputs with analog outputs. The 'old' block will otherwise be lost.

The off-delay block has three inputs. At the top is the trigger input (Trg) you use to start the off-delay time. In our example, the OR block B1 triggers the off-delay. You reset the time and the output with a signal at the reset input. Set the off-delay time at parameter T of the input Par.

In our example we do not use the reset input of the off-delay function, and we identify it with an 'x' connector.



This is what the display should now show

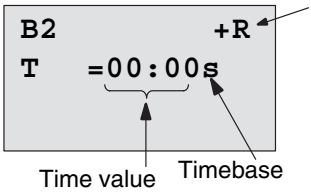
Assigning block parameters

Now you set the off-delay time T:

1. Move the cursor to **Par**, if it not already at this position: Press ▲ or ▼
2. Switch to editing mode: Press **OK**

IDEC SmartRelay shows the parameters in the parameter assignment window:

T: The block parameter B2 is a time function



"+" means: The parameter is shown and can be modified in the parameter assignment mode.
"R" means: Retentivity is enabled for this block.

To change the time value:

- Press ◀ and ▶ to position the cursor.
- Press ▲ and ▼ to modify the value at the relevant position.
- Confirm your entries with **OK**.

Setting the time

Set the time T = 12:00 minutes:

1. Move the cursor to the first digit: Press ◀ or ▶
2. Select the digit '1': Press ▲ or ▼
3. Shift the cursor to the second digit: Press ◀ or ▶
4. Select digit '2': Press ▲ or ▼
5. Move the cursor to the unit: Press ◀ or ▶
6. Select the timebase 'm' (for minutes): Press ▲ or ▼

Showing/hiding parameters - the parameter protection mode

If you want to show/hide the parameter and allow/prevent its modification in parameter assignment mode:

1. Move the cursor to the protection mode: Press ◀ or ▶
2. Select the protection mode: Press ▲ or ▼

The display should now show:

or

Protection mode + : The value of the time T can be modified in parameter assignment mode

Protection mode - : The value of the time T is hidden in parameter assignment mode

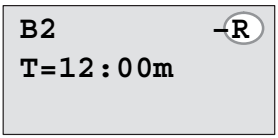
3. Confirm your entries with: **OK**

Enabling/disabling retentivity

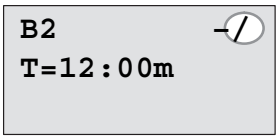
To decide whether you want to retain your current data after a power failure or not:

1. Move the cursor to the retentivity setting: Press ◀ or ▶
2. Select the retentivity setting: Press ▲ or ▼

The display now shows:



or



Retentivity R: Current data is retained

Retentivity /: Current data is not retained

3. Confirm your entries with **OK**

Note

For further information on the protection mode, refer to Chapter 4.3.5.

For further information on retentivity, refer to Chapter 4.3.4

You can modify the protection mode and retentivity setting only in programming mode. This is **not** possible in parameter assignment mode.

In this manual, the protection mode ("+" or "--") and retentivity ("R" or "-/") settings are only shown in the displays where these can actually be changed.

Verification of the circuit program

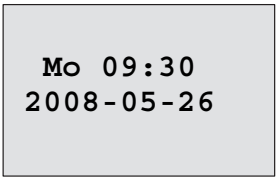
This program branch for Q1 is now completed. IDEC SmartRelay shows you the output Q1. You can once again view the circuit program on the display. Use the keys to browse the circuit program; that is, pres ◀ or ▶ to move from block to block, ▲ and ▼ to move between the inputs at a block.

Closing the programming mode

Although you were shown how to exit the programming mode when you created your first circuit program, here is a reminder:

1. Return to the programming menu: Press **ESC**
2. Return to the main menu: Press **ESC**
3. Move the '>' cursor to '**Start**': Press ▲ or ▼
4. Confirm 'Start': Press **OK**

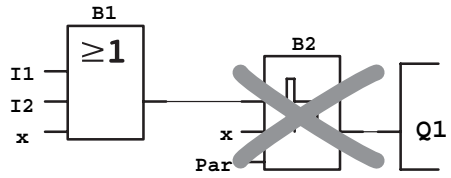
IDEC SmartRelay is back in RUN mode:



You can press ◀ or ▶ to scroll the pages and to monitor the I/O states.

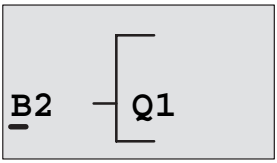
3.6.8 Deleting a block

Let us assume you want to delete the block B2 from your circuit program and connect B1 directly to Q1.



Proceed as follows:

1. Switch IDEC SmartRelay to programming mode (as a reminder, refer to Page 66).
2. Select '**Edit**': Press ▲ or ▼
3. Confirm 'Edit': Press **OK**
   (If required, enter your password and confirm with **OK**.)
4. Select '**Edit Prg**': Press ▲ or ▼
5. Confirm 'Edit Prg': Press **OK**
6. Move the cursor to B2, the input of Q1 Press ◀:

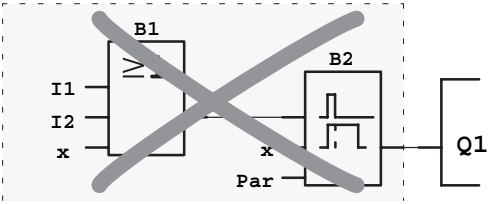


7. Confirm with **OK**.
8. Now replace block B2 with block B1 at output Q1. The procedure:
   - Select the **BN** list: Press ▲ or ▼
   - Accept the BN list: Press **OK**
   - Select '**B1**': Press ▲ or ▼
   - Apply 'B1': Press **OK**

Result: Block B2 is deleted, because it is no longer used in the circuit. Block B1 has replaced B2 directly at the output.

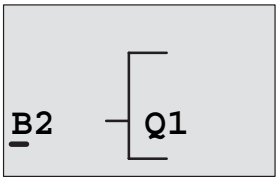
3.6.9 Deleting block groups

Let us assume you want to delete the blocks B1 **and** B2 from the following circuit program (corresponds with the circuit program in Chapter 3.7.7).



Proceed as follows:

1. Switch IDEC SmartRelay to programming mode (as a reminder, refer to page 66).
2. To select '**Edit**': Press ▲ or ▼
3. To confirm 'Edit': Press **OK**
   (If required, enter your password and confirm with **OK**.)
4. To select '**Edit Prg**': Press ▲ or ▼
5. To confirm 'Edit Prg': Press **OK**
6. To move the cursor to the input of Q1; that is, to B2, press ◀:



7. Confirm with OK.
8. Now set the connector 'x' at output Q1 instead of block B2. To do so:
   - Select the **Co** list: Press ▲ or ▼
   - Accept the Co list: Press **OK**
   - Select '**x**': Press ▲ or ▼
   - Apply 'x': Press **OK**

Result: Block B2 is deleted, because it is no longer used in the circuit. This includes all blocks connected to B2. In this example, block B1 also.

3.6.10 Correcting programming errors

Programming errors can be corrected easily in IDEC SmartRelay :

- Provided editing mode is not yet closed, you can revert by one step by pressing **ESC**.
- If you have already configured all inputs, simply reconfigure the faulty input:

1. Move the cursor to the faulty position
2. Change to editing mode. Press **OK**
3. Enter the correct input circuit

You can only replace a block with a block that has exactly the same number of inputs. However, you can delete the old block and then insert a new one. You can choose any new block.

3.6.11 Selecting analog output values for RUN/STOP transition

You can select the analog values that are output at the two analog outputs when IDEC SmartRelay changes from RUN mode to STOP mode**.**

In the programming menu:

1. Move the “>” cursor to ’**Edit..**’: Press ▼ or ▲
2. Select ’Edit’: Press **OK**
3. Move the “>” cursor to ’**AQ**’: Press ▼ or ▲
4. Select ’AQ’: Press **OK**
5. Move the “>” cursor to ’**AQ in Stop**’: Press ▼ or ▲
6. Select ’AQ in Stop’: Press **OK**

IDEC SmartRelay shows the following display:

```
>Defined
 Last
AQ in Stop
 Last
```

The first two rows show your choices. The bottom row shows the current setting for the analog output channels. The default setting is ’Last’.

You can select either ’Defined’ or ’Last’. ’Last’ means that the analog output values are held at their last value and ’Defined’ means that the analog output values are set to specific values. When IDEC SmartRelay changes from RUN mode to STOP mode, the values of the analog outputs change as well, depending on the setting.

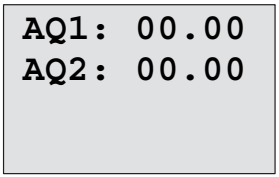
7. Select the desired output setting: Press ▲ or ▼.
8. Confirm your entry: Press **OK**

Defining a specific analog output value

To output a specific analog value at the two analog outputs:

9. Move the '>' cursor to '**Defined**': Press ▲ or ▼
10. Confirm 'Defined': Press **OK**

The display shows:



11. Enter a specific output value for each of the two analog outputs.
12. To confirm your entry: Press **OK**

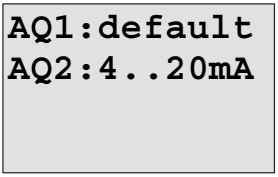
3.6.12 Defining the type of analog outputs

Analog outputs can be either 0..10V/0..20mA, which is the default, or 4..20mA**.**

To define the type of analog outputs, follow these steps starting from the programming menu:

1. Move the ">" cursor to '**Edit..**': Press ▼ or ▲
2. Select 'Edit': Press **OK**
3. Move the ">" cursor to '**AQ**': Press ▼ or ▲
4. Select 'AQ': Press **OK**
5. Move the ">" cursor to '**AQ type**': Press ▼ or ▲
6. Select 'AQ type': Press **OK**

IDEC SmartRelay shows the following display, for example:



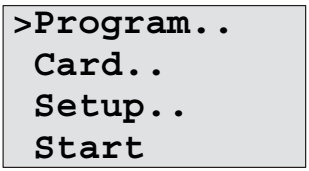
The defined type for each analog channel is shown. To change the type, continue as follows

7. Move to the AQ that you want to change. Press ◀ or ▶
8. Select either default (0..10V/0..20mA) or 4..20mA. Press ▼ or ▲
9. Confirm your selection. Press **OK**

3.6.13 Deleting the circuit program and password

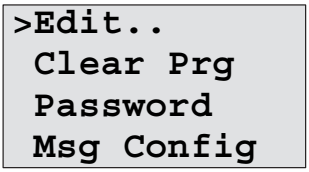
To delete a circuit program and the password if one is defined:

1. Switch the IDEC SmartRelay to programming mode (main menu).



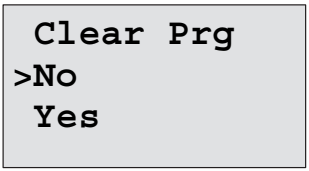
IDEC SmartRelay opens the main menu

2. On the main menu, press ▲ or ▼ to move the '>' cursor to '**Program**'. Press **OK**.



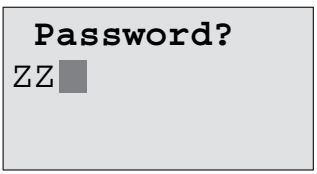
IDEC SmartRelay changes to the programming menu

3. On the programming menu, move the '>' cursor to '**Clear Prg**': Press ▲ or ▼
4. Confirm 'Clear Prg': Press **OK**



To cancel deletion of the circuit program, leave the '>' cursor at '**No**' and press **OK**.
If you are sure that you want to delete the circuit program from memory:

5. Move the '>' cursor to '**Yes**': Press ▲ or ▼
6. Press **OK**.



To prevent unintentional deletion of your circuit program, you are prompted to enter your password (provided you have assigned one).

7. Enter your password.
8. Press **OK**. The circuit program and the password are deleted.

Note

In case that you forget the password, you can delete the circuit program and the password using WindLGC. See the onlinehelp for WindLGC for more details.

For a base module with versions 3 and earlier, you can delete the circuit program and the password by inputting a wrong password on “Clear Prg” menu three times in a row.

For a base module with versions 4 or later, you can delete the circuit program and the password by inputting a wrong password on “Clear Prg” menu a hundred times in a row.

3.6.14 Summertime/wintertime conversion

You can enable or disable automatic summertime/wintertime conversion

- in parameter assignment mode by calling the “Set..” menu command
- in programming mode by calling the “Setup” menu command.

To enable/disable automatic S/W Time conversion in programming mode:

1. Switch IDEC SmartRelay to programming mode.
2. You are now in the main menu and want to select the ’**Setup**’ menu command: Press ▲ or ▼
3. Confirm ’Setup’: Press **OK**
4. Move the ’>’ cursor to ’**Clock**’: Press ▲ or ▼
5. Confirm ’Clock’: Press **OK**
6. Move the ’>’ cursor to ’**S/W Time**’: Press ▲ or ▼
7. Confirm ’S/W Time’: Press **OK**

IDEC SmartRelay shows the following display:

```
>On
 Off
S/W Time:
 Off
```

The current setting of automatic S/W Time conversion is shown on the bottom row. The default setting is ’Off’: disabled.

To enable/disable automatic S/W Time conversion in parameter assignment mode:

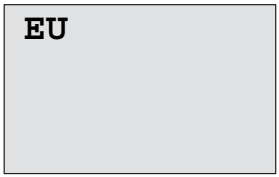
If you want to enable/disable automatic S/W Time conversion in parameter assignment mode, select in the parameter assignment menu '**Set..**', then menus '**Clock**' and '**S/W Time**'. You can now enable/disable automatic S/W Time conversion.

Enabling summertime/wintertime conversion

You now want to enable this conversion and define or set its parameters:

1. Move the '>' cursor to 'On': Press ▲ or ▼
2. Confirm 'On': Press **OK**

The display shows:



3. Select the desired conversion: Press ▲ or ▼

What is shown on the display ?:

- '**EU**' represents the start and end of European summertime.
- '**UK**' represents the start and end of summertime in the United Kingdom.
- '**US1**' represents the start and end of daylight saving time (summertime) in the United States prior to 2007.
- '**US2**' represents the start and end of daylight saving time (summertime) in the United States in 2007 and later years.
- '**AUS**' represents the start and end of Australian summertime.
- '**AUS-TAS**' represents the start and end of Australian/ Tasmanian summertime.
- '**NZ**' represents the start and end of New Zealand summertime.
- **. .** : Here you can enter any month, day and time zone difference.

The table below lists the preset conversions:

	Start of summertime	End of summertime	Time zone difference Δ
EU	Last Sunday in March: 02:00-->03:00	Last Sunday in October: 03:00-->02:00	60 Min.
UK	Last Sunday in March: 01:00-->02:00	Last Sunday in October: 02:00-->01:00	60 Min.
US1	First Sunday in April: 02:00-->03:00	Last Sunday in October: 02:00-->01:00	60 Min.
US2	Second Sunday in April: 02:00-->03:00	First Sunday in November: 02:00-->01:00	60 Min.
AUS	Last Sunday in October: 02:00-->03:00	Last Sunday in March: 03:00-->02:00	60 Min.
AUS-TAS	First Sunday in October: 02:00-->03:00	Last Sunday in March: 03:00-->02:00	60 Min.
NZ	First Sunday in October: 02:00-->03:00	Third Sunday in March: 03:00-->02:00	60 Min.
..	Customized month and day; 02:00-->02:00 + Time zone difference	Customized month and day; Time zone difference: 03:00-->03:00 - Time zone difference	User-defined (resolution in minutes)

Note

You can specify a time zone difference Δ between 0 and 180 minutes.

Let us assume you want to enable European summertime/ wintertime conversion:

4. Move the '>' cursor to '**EU**': Press ▲ or ▼
5. Confirm 'EU': Press **OK**

IDEC SmartRelay shows the following display:

```
>On
 Off
S/W Time:
 On→EU
```

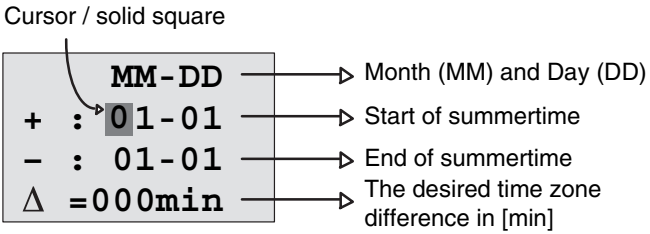
IDEC SmartRelay indicates that European S/W Time conversion is enabled.

User-defined parameters

If none of the parameters/conversions apply to your country, you can customize these under menu item '**. .**'. To do so:

1. Confirm 'On' once again: Press **OK**
2. Move the '>' cursor to '**. .**': Press ▲ or ▼
3. Confirm the menu item '. .' : Press **OK**

The display shows:

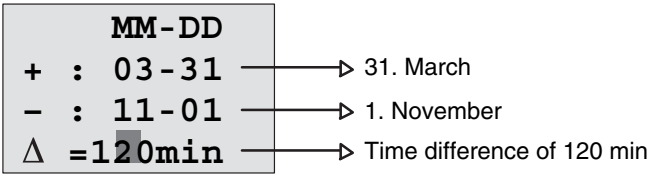


Let us assume you want to configure the following parameters: Start of summertime = 31st March, end of summertime = 1st November, time difference of 120 minutes.

This is how you can enter your data:

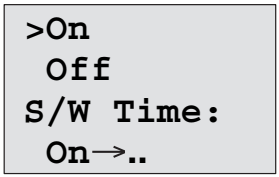
- Press ◀ and ▶ to move the solid square/cursor.
- Press ▲ and ▼ to change the value at the cursor position.

The display shows:



- Confirm all your entries with **OK**.

You have now customized the summertime/wintertime conversion. The IDEC SmartRelay display now shows:



IDEC SmartRelay indicates that summertime/wintertime conversion is enabled, and that user-defined parameters ('..') have been set.

Note

To disable summertime/wintertime conversion in this menu, you merely confirm ‘Off’ with **OK**.

Note

Summertime/wintertime conversion only functions when IDEC SmartRelay is operating (in RUN or STOP status). It does not function when IDEC SmartRelay is in buffered operation (see Chapter 4.3.3).

3.6.15 Synchronization

Time synchronization between IDEC SmartRelay and the connected expansion modules can be enabled/disabled in programming mode by means of the real-time clock menu (“Clock” menu item).

1. Switch the IDEC SmartRelay to programming mode.
2. You are now in the main menu, and want to select ‘**Clock**’: Press ▲ or ▼
3. Confirm ‘Clock’: Press **OK**
4. Move the ‘>’ cursor to ‘**Sync**’: Press ▲ or ▼
5. Apply ‘Sync’: Press **OK**

IDEC SmartRelay shows the following display:

```
>On
 Off
Sync:
 Off
```

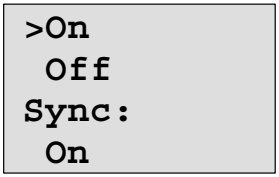
The current setting of the automatic synchronization function is displayed in the bottom row. The default setting is ‘Off’: disabled.

Enabling synchronization

You want to enable synchronization:

1. Move the '>' cursor to '**On**': Press ▲ or ▼
2. Confirm 'On': Press **OK**

IDEC SmartRelay shows the following display:



When synchronization is enabled, IDEC SmartRelay transmits the time-of-day to the expansion modules once daily, after each transition to RUN mode and when the TOD is changed after a 'Set Clock' is executed or after a summertime/wintertime conversion.

3.7 Memory space and circuit program size

The size of a circuit program in IDEC SmartRelay is limited by the memory space (memory used by the blocks).

Memory areas

- **Program memory**:
  IDEC SmartRelay allows only a limited number of blocks in your circuit program.
  The second limitation is based on the maximum number of bytes a circuit program may contain. The total number of bytes used can be determined by adding up the number of bytes used for the relevant function blocks.
- **Retentive memory (Rem)**:
  In this area, IDEC SmartRelay stores values which need to be retentive, for example, the operating hours counter value. Blocks with optional retentivity use this memory area only if this function is actually enabled.

Caution

At a power failure, the logical input level may drop to zero before IDEC SmartRelay can save the functions to the retentive memory. In this case, the IDEC SmartRelay saves the function values determined by the zero state at its inputs of the inputs.

Example: On-delay
With an input (I1) connected to a Trg connector of an On-delay FB as shown in Fig.1, if I1 is ON and the IDEC SmartRelay power is turned off and on, the timer current value of the On-delay FB is sometimes reset as shown in Fig.2.

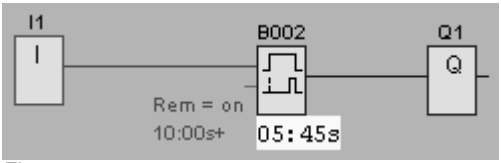


Fig. 1

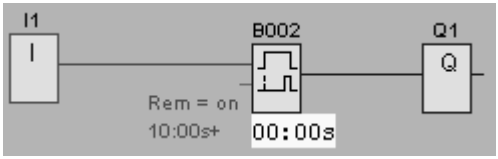


Fig. 2

Other FBs are shown below.

- Function blocks whose timer current value is sometimes reset. Off-delay, On-delay, On-/Off-delay, Retentive on-delay, Interval time-delay relay/Pulse output, Edge-triggered interval time-delay relay, Operating hours counter, Asynchronous pulse generator, Stairwell Light Switch, Dual-function switch
- Function blocks whose output is sometimes set or reset when input (I*) is connected to a S(R) connector with NOT. Latching relay, Current impulse relay

Resources available in IDEC SmartRelay

A circuit program in IDEC SmartRelay can occupy the following maximum resources:

Bytes	Blocks	REM
3800	200	250

IDEC SmartRelay monitors memory utilization, and offers only those functions from the lists for which it can actually provide sufficient memory space.

Memory requirements

The table below shows an overview of the memory requirements for the basic and special function blocks:

Function	Program memory	Rem memory*
Basic functions		
AND	12	-
AND with Edge Detection	12	-
NAND (not AND)	12	-
NAND with Edge Detection	12	-
OR	12	-
NOR (not OR)	12	-
XOR (exclusive OR)	8	-
NOT (Negation)	4	-
Special functions		
Timers		
On-delay	8	3
Off-delay	12	3
On-/Off-delay	12	3
Retentive on-delay	12	3
Interval time-delay relay/Pulse output	8	3
Edge-triggered interval time-delay relay	16	4
Asynchronous pulse generator	12	3
Random generator	12	-
Stairwell Light Switch	12	3
Dual-function switch	16	3
Seven-day time switch	20	-
Twelve-month time switch	12	-
Counters		
Up/down counter	28	5

Function	Program memory	Rem memory*
Operating hours counter	28	9
Frequency trigger	16	-
Analog		
Analog trigger	16	-
Analog differential trigger	16	-
Analog comparator	24	-
Analog value monitoring	20	-
Analog amplifier	12	-
Pulse Width Modulator (PWM)	24	-
Analog math	20	-
Analog math error detection	12	1
Analog multiplexer	20	-
Analog ramp control	36	-
PI controller	40	2
Others		
Latching relay	8	1
Current impulse relay	12	1
Message texts	8	-
Softkey	8	2
Shift register	12	1

*: Bytes in the Rem memory area if retentivity is enabled.

Utilization of memory areas

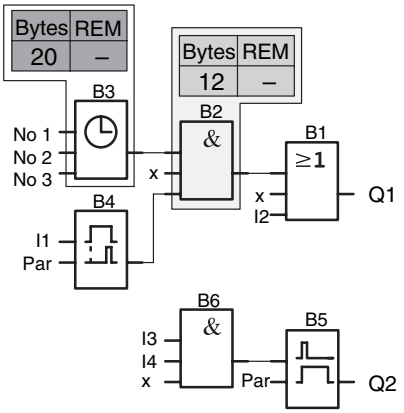
The system indicates that there is insufficient memory space by not allowing you to add a further block to your circuit program. IDEC SmartRelay offers you only the blocks for which it can provide sufficient memory space. If IDEC SmartRelay memory space is insufficient to hold any further blocks you select from a block list, the system will deny access to this list.

If memory space is fully occupied, optimize your circuit program or install a second IDEC SmartRelay

Calculating memory requirements

When calculating the memory requirements of a circuit, you must always take into account all individual areas of memory.

Example:



The sample circuit program contains:

Block no.	Function	Memory area		
		Bytes	Blocks	REM
B1	OR	12	1	-
B2	AND	12	1	-
B3	Seven-day time switch	20	1	-
B4	On-delay*	8	1	3
B5	Stairwell Light Switch	12	1	0
B6	AND	12	1	-
	Resources used by the circuit program	76	6	3
	Memory space limits in IDEC SmartRelay	3800	200	250
	Still available in IDEC SmartRelay	3724	194	247

*: Configured with retentivity.

This means that this circuit program fits in IDEC SmartRelay.

Indication of available memory space

IDEC SmartRelay shows you the amount of free memory space.

Proceed as follows:

1. Switch IDEC SmartRelay to programming mode (as a reminder, refer to page 66).
2. Select '**Edit**': Press ▲ or ▼
3. Accept 'Edit': Press **OK**
4. Select '**Memory?**': Press ▲ or ▼
5. Accept 'Memory?': Press **OK**

The display now shows:

```
Free Memory:
Byte =3724
Block= 194
Rem  = 247
```

IDEC SmartRelay functions 4

Organization

IDEC SmartRelay provides you with various elements in programming mode, which are organized in the following lists:

- ↓**Co**: Connector list (**Co**nnector)
  (see Chapter 4.1)
- ↓**GF**: List of the basic functions AND, OR, ...
  (refer to Chapter 4.2)
- ↓**SF**: List of the special functions
  (refer to Chapter 4.4)
- ↓**BN**: List of reusable blocks configured in the circuit program

List contents

All lists show the elements available in IDEC SmartRelay Usually, this includes *all* connectors, basic functions, and special functions. The ↓**BN** list shows all the blocks that you have created in IDEC SmartRelay.

If not all is shown

IDEC SmartRelay does *not* show all elements if:

- No further blocks may be added.
  This is either an indication of insufficient memory space or that the maximum number of blocks has been reached.
- A specific block's memory space requirement would exceed the space available in IDEC SmartRelay

See Chapter 3.7.

4.1 Constants and connectors - Co

Constants and connectors (= Co) represent inputs, outputs, memory markers and constant voltage levels (constants).

Inputs:

1) Digital inputs

Digital inputs are identified with an **I.** The number of the digital inputs (I1, I2, ...) corresponds to the number of the input connectors of the IDEC SmartRelay base module and of the connected digital modules, in the order of their installation. The fast digital inputs I3, I4, I5, and I6 of the IDEC SmartRelay versions FL1E-H12SND, FL1E-H12RCE and FL1E-B12RCE can be used as fast counters.

2) Analog inputs

The IDEC SmartRelay versions FL1E-H12SND, FL1E-H12RCE and FL1E-B12RCE are equipped with the inputs I1, I2, I7 and I8, which can also be programmed for use as **AI3, AI4, AI1** and **AI2** inputs. As described in section 5.2.4, you can configure these modules to use either two analog inputs (AI1 and AI2), or all four. Signals at the I1, I2, I7 and I8 inputs are interpreted as digital values, and those at the AI3, AI4, AI1 and AI2 inputs are interpreted as analog values. Note that AI3 corresponds to I1 and AI4 corresponds to I2. This numbering preserves the previous correspondence of AI1 to I7 and AI2 to I8 that was available with the FL1D series.The inputs of a connected analog module are numbered according to the already existing analog inputs. See section 2.1.1 for example setups. In programming mode, when you select the input signal of a special function that takes an analog input, IDEC SmartRelay offers the analog inputs AI1...AI8, Analog memory markers AM1...AM6, analog outputs AQ1 and AQ2, and the block numbers of functions with analog outputs.

Outputs:

1) Digital outputs

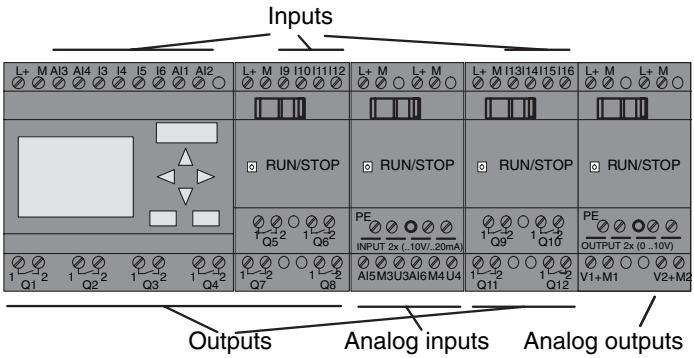
Digital outputs are identified by the character **Q**. The output numbers (Q1, Q2, ... Q16) correspond with the numbers of the output connectors at the IDEC SmartRelay base module and with those of the expansion modules, in their order of installation. See the following figure.

There are also 16 blank outputs available. These are identified with an **x** and cannot be reused in a circuit program (in contrast to memory markers, for example). The list shows all programmed blank outputs, and one blank output which is not yet configured. A blank output, for example, is useful for the special function ”Message texts” (see Chapter 4.4.23), if only the message text is of significance to a circuit program.

2) Analog outputs

Analog outputs are identified by the letters **AQ**. Two analog outputs are available, namely AQ1 and AQ2. An analog output can only be connected with the analog input of a function, an analog memory marker AM or an analog output connector.

The following figure shows an example IDEC SmartRelay configuration and the numbering of the inputs and outputs for the circuit program.



Memory Markers

Memory Markers are identified by the letters M or AM . These are virtual outputs, which output the value of their inputs. IDEC Smart-Relay provides 27 digital memory markers M1 ... M27 and 6 analog memory markers AM1 ... AM6.

Startup Marker

Marker M8 is set in the first cycle of the user program and can thus be used in your circuit program as a startup marker. This signal is automatically reset after the circuit program has completed its first cycle.

The M8 marker can be used in all further cycles for setting, deletion and evaluation procedures in the same way as other markers.

Backlight flags M25 and M26

The M25 flag controls the backlight of the IDEC SmartRelay Display. The M26 flag controls the backlight of the Text Display.

Note: The backlight lifetime of the Text Display is 20,000 hours.

Message text character set flag M27

The M27 flag selects between the two character sets that IDEC SmartRelay uses to display message texts. State 0 corresponds to Character Set 1, and state 1 corresponds to Character Set 2. If M27=0 (low), only message texts configured for Character Set 1 will display; If M27=1 (high), only message texts configured for Character Set 2 will display. If you do not include M27 in the circuit program, message texts display in the character set that you selected from either the Msg Config menu or from WindLGC.

Note

The output of the marker always carries the signal of the previous program cycle. This value does not change within the same program cycle.

Shift register bits

IDEC SmartRelay provides the shift register bits S1 to S8, which are assigned the read-only attribute in the circuit program. The content of shift register bits can only be modified by means of the ”Shift register” special function (see Chapter 4.4.25).

Cursor keys

Up to four cursor keys are available to you, namely C ▲, C ▶, C ▼ and C ◀ (”C” = ”Cursor”). Cursor keys are programmed for the circuit program in the same way as other inputs. You can set the cursor keys in the corresponding display while the system is in RUN (see Chapter 3.6.6), and in an active message text (ESC + Key). Cursor keys can save switches and inputs, and allow operator control of the circuit program. Cursor key inputs from the Text Display are identical to cursor key inputs from the IDEC SmartRelay module.

Text Display function keys

The Text Display has four function keys that you can use in your circuit program. You program these keys in the same way as other inputs. Like the cursor keys, you can press these keys when IDEC SmartRelay is in RUN mode to affect the behavior of the circuit program, and to save switches and inputs. They are identified as F1, F2, F3, and F4.

Levels

Voltage levels are designated **hi** and **lo**. A constant ”1” = hi or ”0” = lo status at the block can be set by means of a permanent voltage level or constant value hi or lo.

Open connectors

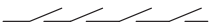
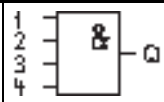
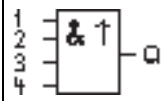
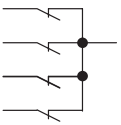
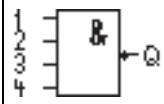
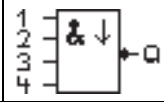
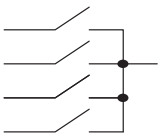
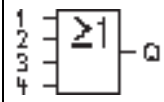
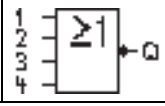
Unused block connectors can be identified with an **x**.

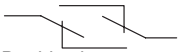
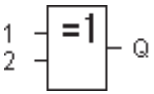
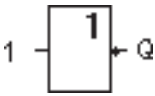
4.2 Basic functions list - GF

Basic functions represent simple logical elements of Boolean algebra.

You can invert the inputs of individual basic functions, that is, the circuit program inverts a logical ”1” at a relevant input to a logical ”0”; if ”0” is set at the input, the program sets a logical ”1”. A programming example is found in Chapter 3.6.3.

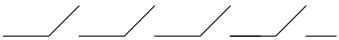
The GF list contains the basic function blocks you can use for your circuit program. The following basic functions are available:

View in the circuit diagram	View in IDEC SmartRelay	Name of the basic function
 Series circuit normally open contact		AND (see page 115)
		AND with Edge Detection (see page 116)
 Parallel circuit with normally closed contacts		NAND (not AND) (see page 116)
		NAND with Edge Detection (see page 117)
 Parallel circuit with normally open contacts		OR (see page 118)
Series circuit with normally closed contacts		NOR (not OR) (see page 119)

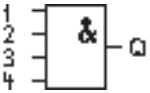
View in the circuit diagram	View in IDEC SmartRelay	Name of the basic function
 Double changeover contact		XOR (exclusive OR) (see page 120)
Normally Closed Contact		NOT (negation, inverter) (see page 120)

4.2.1 AND

Circuit diagram of a series circuit with several normally open contacts:



Symbol in IDEC SmartRelay:



The output of the AND is only 1 if **all** inputs are 1, i.e. all contacts are closed.

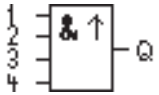
At an unused block input (x): x = 1.

AND function logic table

1	2	3	4	Q
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

4.2.2 AND with Edge Detection

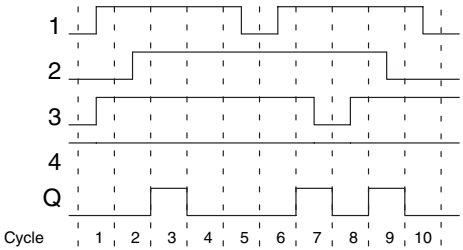
Symbol in IDEC SmartRelay:



The output of an edge triggered AND is only 1 if **all** inputs are 1 and if **at least one** input was low in the previous cycle.

At an unused block input (x): x = 1.

Timing diagram for the AND with Edge Detection



4.2.3 NAND (not AND)

Parallel circuit with multiple normally closed contacts in the circuit diagram:

Symbol in IDEC SmartRelay:

The output of the NAND is only 0 if the status at **all** inputs is 1, i.e. the contacts are closed.

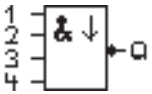
At an unused block input (x): x = 1.

NAND function logic table

1	2	3	4	Q
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

4.2.4 NAND with Edge Detection

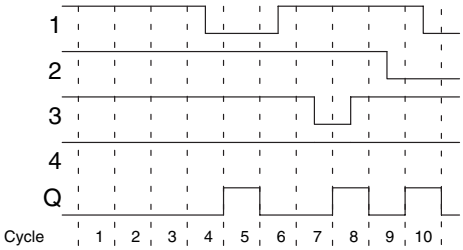
Symbol in IDEC SmartRelay:



The output status of the NAND with Edge Detection is only 1 if **at least one** input is 0 and if **all** inputs were 1 in the previous cycle.

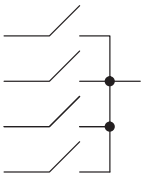
At an unused block input (x): x = 1.

Timing diagram for the NAND with Edge Detection

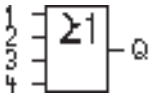


4.2.5 OR

Circuit diagram of a parallel circuit with several normally open contacts:



Symbol in IDEC SmartRelay:



The output status of the OR element is only 1 if **at least one** input is 1, i.e. at least one of the contacts is closed.

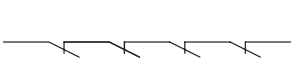
At an unused block input (x): x = 0.

OR function logic table

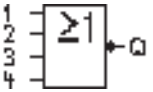
1	2	3	4	Q
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

4.2.6 NOR (not OR)

Circuit diagram of a series circuit with several normally closed contacts:



Symbol in IDEC SmartRelay:



The output status of the NOR is only 1 if **all** inputs are 0, i.e. if switched off. The NOR output is set to 0 when one of the inputs is switched on (logical 1 status).

At an unused block input (x): x = 0.

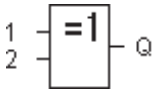
NOR function logic table

1	2	3	4	Q
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

4.2.7 XOR (exclusive OR)

The XOR in a circuit diagram, shown as series circuit with 2 changeover contacts:

Symbol in IDEC SmartRelay:



The output status of the XOR is 1 if the inputs are **not equivalent**.

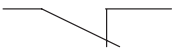
At an unused block input (x): x = 0.

XOR function logic table

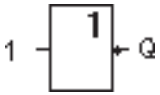
1	2	Q
0	0	0
0	1	1
1	0	1
1	1	0

4.2.8 NOT (Negation, Inverter)

A normally closed contact in the circuit diagram:



Symbol in IDEC SmartRelay:



The output status is 1 if the input is 0. The NOT block inverts the input status.

Advantage of the NOT block, for example: IDEC SmartRelay does not require normally closed contacts. You simply use a normally open contact and the NOT block to convert these into a normally closed contact.

NOT function logic table

1	Q
0	1
1	0

4.3 Special functions

Because of their different input designation, you can see right away that there is a difference between the special functions and basic functions. SFs contain timer functions, retentive functions and various parameter assignment options, which allow you to adapt the circuit program to suit your own requirements.

This section provides you with a brief overview of input designations and with some particular background information on SFs. The SFs in particular are described in Chapter 4.4.

4.3.1 Designation of the inputs

Logical inputs

Here, you will find the description of the connectors you can use to create a logical link to other blocks or to the inputs of the IDEC SmartRelay unit.

- **S (Set):**
  A signal at input S sets the output to logical “1”.
- **R (Reset):**
  The reset input R takes priority over all other inputs and resets the outputs.
- **Trg (Trigger):**
  This input is used to trigger the start of a function.
- **Cnt (Count):**
  This input is used for counting pulses.
- **Fre (Frequency):**
  Frequency signals to be evaluated are applied to this input.
- **Dir (Direction):**
  This input determines the direction, + or -.
- **En (Enable):**
  This input enables a block function. When this input is ”0”, other signals to the block will be ignored.
- **Inv (Invert):**
  A signal at this input is inverted.
- **Ral (Reset all):**
  All internal values are reset.

Note

Unused logical inputs of special functions default to logical "0".

Connector X at SF inputs

SF inputs connected to connector x are set low. That is, the inputs carry a 'lo' signal.

Parameter inputs

At some of the inputs you do not apply any signals. You configure the relevant block values instead. Examples:

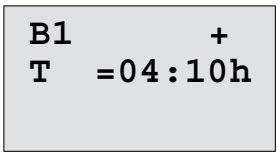
- **Par (Parameter):**
  This input will not be connected. Here, you set the relevant block parameters (times, on/off thresholds etc.).
- **No (Cam):**
  This input will not be connected. Here, you configure the time patterns.
- **P (Priority):**
  This is an open input. Here, you define priorities and specify whether a message is to be acknowledged in RUN.

4.3.2 Time response

Parameter T

At some of the SFs it is possible to configure a time value T. When you preset this time, note that your input values are based on the timebase set:

Timebase	_ _ : _ _
s (seconds)	seconds : $^{1}/_{100}$ seconds
m (minutes)	minutes : seconds
h (hours)	hours : minutes



Setting a time T of 250 minutes:
Unit in hours h:

04:00 hours	240 minutes
00:10 hours	+10 minutes
=	250 minutes

Accuracy of T

Because of slight tolerances in the characteristics of electronic components, the set time T may deviate. You can find a detailed description of such deviations in the "On-delay" topic (Page 131).

Accuracy of the timer (Seven-day/Twelve-month time switch)

To prevent timing inaccuracy of the real-time clock in C versions caused by this deviation, the timer value is continuously compared with a high-precision timebase and corrected. The resultant maximum timing inaccuracy is ±5 s/day.

4.3.3 Backup of the real-time clock

Because the internal real-time clock of an IDEC SmartRelay is backed up, it continues operation after a power failure.

The ambient temperature influences the backup time. At an ambient temperature of 25°C, the typical backup time is 80 hours.

If there is a power outage of an IDEC SmartRelay for more than 80 hours, the internal clock responds, as shown below:

On restarting, the clock is set to "Sunday 00:00 1 January". The time is stopped and flashes. IDEC SmartRelay is back in the status that it was in before the power outage. In the RUN status, the system processes the counters that were parameterized with the time above. The clock is, however, still stopped.

- Equipment series FL1E:
  If you are using the optional IDEC SmartRelay Battery cartridge, or combined IDEC SmartRelay Memory/ Battery cartridge, IDEC SmartRelay can retain the clock time for up to two years. These cartridges are available for equipment series FL1E. To backup the real time clock for more than 80 hours, insert a battery cartridge or a combined memory/battery cartridge to the base module.

4.3.4 Retentivity

The switching states, counter and time values of many SFs can be set retentive. This means that current data are retained after a power failure, and that the block resumes operation at the break point. The timer is not reset, but

resumes operation until the time-to-go has expired, for example.
To enable this response, however, the relevant functions must be set retentive. Two options are available:

R : The data is retained.

/ : Current data is not retained (default). See the example on Page 90.

SFs operating hours counter, seven-day time switch, twelve-month time switch and PI controller are always retentive.

4.3.5 Parameter protection

In the parameter protection settings, you can determine whether or not the parameters can be displayed and edited in IDEC SmartRelay parameter assignment mode. Two options are available:

+ : The parameter attribute permits read/write access in parameter assignment mode (default).

- : The parameter settings are read-/write-protected in parameter assignment mode, and can be edited only in programming mode. See the example on Page 90.

Note

Parameter protection covers only the "Set Param" window. If you embed variables of protected special functions in a message text, the variables are still editable from the message text. To protect these variables, also activate the protection of the message text.

4.3.6 Calculating the gain and offset of analog values

A sensor is connected to the analog input and converts a process variable into an electrical signal. This value of signal lies within the typical range of this sensor.

IDEC SmartRelay always converts the electrical signals at the analog input into digital values from 0 to 1000.

A voltage of 0 to 10 V at input AI is transformed internally into a range of values from 0 to 1000. An input voltage exceeding 10 V is shown as internal value 1000.

Because you cannot always process the range of values from 0 to 1000 as predetermined by IDEC SmartRelay, you can multiply the digital values by a gain factor and then shift the zero of the range of values (offset). This allows you to output an analog value to the IDEC SmartRelay display, which is proportional to the actual process variable.

Parameter	Minimum	Maximum
Input voltage (in V)	0	≥ 10
Internal value	0	1000
Gain	-10.00	+10.00
Offset	-10000	+10000

Mathematical rule

Actual value **Ax** =
(internal value at input Ax • gain) + offset

Gain and offset calculation

The gain and offset is calculated based on the relevant high and low values of the function.

Example 1:

The available thermocouples have the following technical data: -30 to +70°C, 0 to 10 V DC (i.e. 0 to 1000 in IDEC SmartRelay).

Actual value = (internal value • gain) + offset, thus

-30 = (0 • A) + B, i.e. offset B = -30

+70 = (1000 • A) -30, i.e. gain A = 0.1

Example 2:

A pressure sensor converts a pressure of 1000 mbar into a voltage of 0 V, and a pressure of 5000 mbar into a voltage of 10 V.

Actual value = (internal value • gain) + offset, thus

1000 = (0 • A) + B, i.e. offset B = 1000

5000 = (1000 • A) +1000, i.e. gain A = 4

Example of analog values

Process variable	Voltage (V)	Internal value	Gain	Offset	Value shown (Ax)
-30°C	0	0	0.1	-30	-30
0°C	3	300	0.1	-30	0
+70°C	10	1000	0.1	-30	70
1000 mbar	0	0	4	1000	1000
3700 mbar	6.75	675	4	1000	3700
5000 mbar	10	1000	4	1000	5000
	0	0	0.01	0	0
	5	500	0.01	0	5
	10	1000	0.01	0	10
	0	0	1	0	0
	5	500	1	0	500
	10	1000	1	0	1000
	0	0	10	0	0
	5	500	10	0	5000
	10	1000	10	0	10000
	0	0	0.01	5	5
	5	500	0.01	5	10
	10	1000	0.01	5	15
	0	0	1	500	500
	5	500	1	500	1000
	10	1000	1	500	1500
	0	0	1	-200	-200
	5	500	1	-200	300
	10	1000	1	-200	800
	0	0	10	-10000	-10000
	10	1000	10	-10000	0
	0.02	2	0.01	0	0
	0.02	2	0.1	0	0
	0.02	2	1	0	2
	0.02	2	10	0	20

A sample application is found in the description of the ”Analog comparator” SF on Page 177.

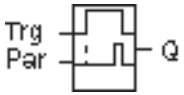
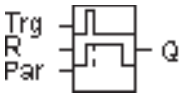
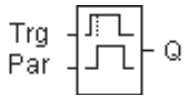
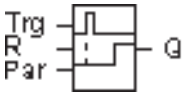
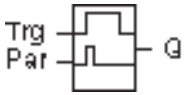
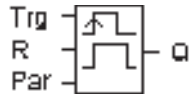
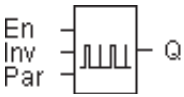
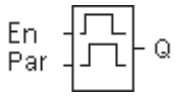
For further information on analog inputs, refer to Chapter 4.1.

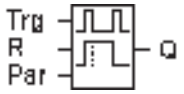
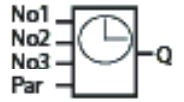
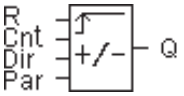
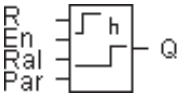
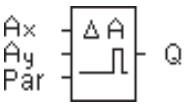
4.4 Special functions list - SF

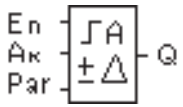
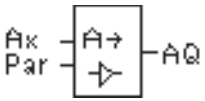
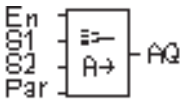
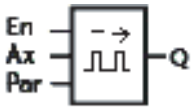
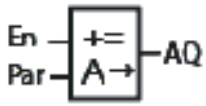
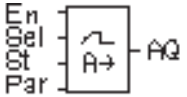
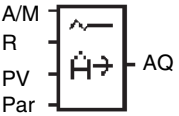
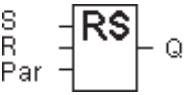
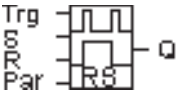
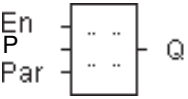
When you create your circuit program in IDEC SmartRelay, you find the special function blocks in the SF list.

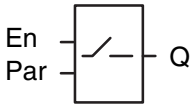
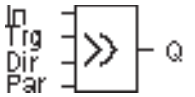
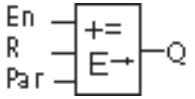
You can invert the inputs of SFs individually, that is, the circuit program converts a logical ”1” at the input into a logical ”0”; a logical ”0” it converts into a logical ”1”. An example of the program code is found in Chapter 3.6.3.

The table also specifies whether the relevant function can be set retentive (Rem). The following SFs are available:

View in IDEC SmartRelay	Name of the special function	Rem
Times		
	On-delay (see page 131)	REM
	Off-delay (see page 135)	REM
	On-/Off-delay (see Page 136)	REM
	Retentive on-delay (see page 138)	REM
	Interval time-delay relay/Pulse output (see page 139)	REM
	Edge-triggered interval time-delay relay (see page 140)	REM
	Asynchronous pulse generator (see Page 142)	REM
	Random generator (see page 144)	

View in IDEC SmartRelay	Name of the special function	Rem
	Stairwell Light Switch (see page 146)	REM
	Dual-function switch (see page 148)	REM
	Seven-day time switch (see Page 150)	
	Twelve-month time switch (see Page 155)	
Counter		
	Up/down counter (see Page 161)	REM
	Operating hours counter (see page 164)	REM
	Frequency trigger (see Page 168)	
Analog		
	Analog trigger (see page 171)	
	Analog differential trigger (see page 174)	
	Analog comparator (see Page 177)	

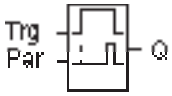
View in IDEC SmartRelay	Name of the special function	Rem
	Analog value monitoring (see Page 182)	
	Analog amplifier (see Page 185)	
	Analog multiplexer (see Page 210)	
	Pulse Width Modulator (PWM) (see Page 222)	
	Analog math (see Page 225)	
	Analog ramp control (see Page 212)	
	PI controller (see Page 216)	REM
Miscellaneous		
	Latching relay (see Page 190)	REM
	Current impulse relay (see Page 191)	REM
	Message texts (see Page 193)	

View in IDEC SmartRelay	Name of the special function	Rem
	Softkey (see Page 205)	REM
	Shift register (see Page 208)	REM
	Analog math error detection (see Page 230)	

4.4.1 On-delay

Short description

The output is only set after a configurable on-delay time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the on-delay timer.
	Parameter	T represents the time after which the output is switched on (0 to 1 transition of the output signal). Retentivity: / = no retentivity R = the status is retentive.
	Output Q	Q is switched on when the set time T has expired, provided Trg is still set.

Parameter T

Note the defaults for parameter T in Chapter 4.3.2.

The time for parameter T can also be preset based on the actual value of another, already-configured function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is adjustable. Please note the following listing:

Valid ranges of the timebase, if T = parameter

Timebase	max. value	min. resolution	Accuracy
s (seconds)	99:99	10 ms	± 10 ms
m (minutes)	99:59	1s	± 1 s
h (hours)	99:59	1 min	± 1 min

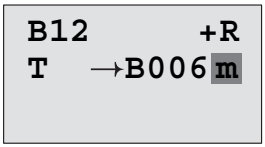
The display in programming mode (example):

```
B12      +R
T  =04:10h
```

Valid ranges of the timebase, if T = Actual value of an already-programmed function

Timebase	max. value	Meaning	Accuracy
ms	99990	Number of ms	± 10 ms
s	5999	Number of s	± 1 s
m	5999	Number of min	± 1 min

The display in programming mode (example):

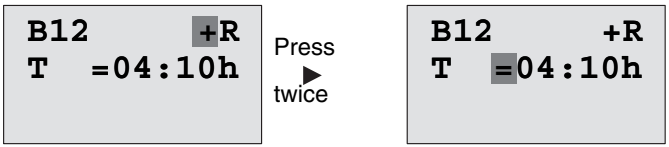


If the referenced block (B6, in the example) returns a value that lies out of the valid range, the value is rounded up or down to the next valid value.

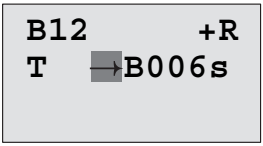
Parameter preset = Actual value of an already-programmed function

How to include the actual value of an already-programmed function:

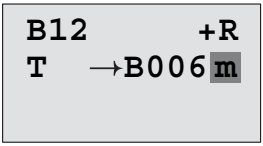
1. Press ▶ to move the cursor to the equal sign of parameter T.



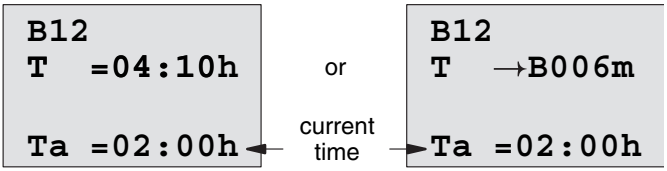
2. Press ▼ to change the equal sign into an arrow. If it exists, the last referenced block and its timebase is shown.



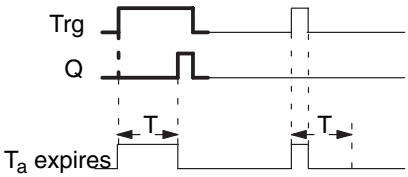
3. Press ▶ to move the cursor to the ”B” of the shown block, and then press ▼ to select the required block number.
4. Press ▶ to move the cursor to the block’s timebase and press ▼ to select the required timebase.



The view in parameter assignment mode (example):



Timing diagram



The bold section of the timing diagram is also shown in the on-delay icon.

Functional description

The time T_a is triggered with a 0 to 1 transition at input Trg (T_a is the current IDEC SmartRelay time).

If the status of input Trg is 1 at least for the duration of the configured time T, the output is set to 1 on expiration of this time (the output follows the input with on-delay).

The time is reset when the status at input Trg returns to 0 before the time T has expired.

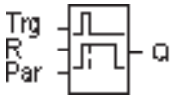
The output is reset to 0 when the signal at input Trg is 0.

If retentivity is not set, output Q and the expired time are reset after a power failure.

4.4.2 Off-delay

Short description

When an on-delay is set, the output is reset when the configured time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	The off-delay timer starts with a negative edge (1 to 0 transition) at input Trg (Trigger)
	Input R	A signal at input R resets the on-delay time and the output.
	Parameter	The output switches off (transitions from 1 to 0) when the delay time T expires. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set with a signal at input Trg. It holds this state until T has expired.

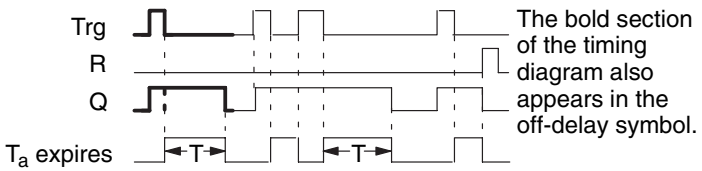
Parameter T

Note the parameter T defaults specified in Chapter 4.3.2. The time for parameter T can be based on the actual value of another, already-configured function. You can use the actual value of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid timebase ranges and parameter preset, refer to Chapter 4.4.1.

Timing diagram



Functional description

Output Q is set to hi immediately when the input Trg changes to hi.

The actual time T_a in IDEC SmartRelay is retriggered at the 1 to 0 transition of Trg. The output remains set. Output Q is reset to 0 with off-delay when T_a reaches the value configured at T (T_a=T).

The time T_a is retriggered with a one-shot at input Trg.

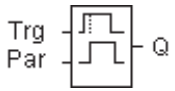
You can set input R (Reset) to reset the time T_a and the output before T_a has expired.

If retentivity is not set, output Q and the expired time are reset after a power failure.

4.4.3 On-/Off-delay

Short description

The on-/off-delay function sets the output after the set on-delay time has expired, and resets it upon expiration of the off-delay time.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A positive edge (0 to 1 transition) at input Trg (Trigger) triggers the on-delay time T_H. A negative edge (1 to 0 transition) at input Trg (Trigger) triggers the off-delay time T_L.
	Parameter	T_H is the time after which the output is set hi (output signal transition 0 to 1). T_L is the time after which the output is reset (output signal transition 1 to 0). Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set when the configured time T_H has expired and Trg is still set. It is reset on expiration of the time T_L, if the trigger Trg has not been set again.

Parameters T_H and T_L

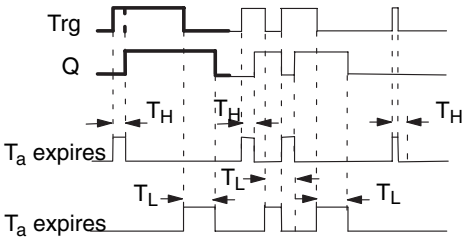
Note the preset values for the parameters T_H and T_L in Chapter 4.3.2.

The on-delay and off-delay times for parameters T_H and T_L can be based on the actual value of another, already-configured function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid timebase ranges and parameter preset, refer to Chapter 4.4.1.

Timing diagram



The bold section of the timing diagram is also shown in the on/off-delay symbol.

Functional description

The time T_H is triggered with a 0 to 1 transition at input Trg.

If the status at input Trg is 1 at least for the duration of the time T_H, the output is set to 1 on expiration of the time T_H (the output follows the input with on-delay).

The time is reset when the signal at input Trg is reset to 0 before the time T_H has expired..

A 1 to 0 transition at input Trg triggers the time T_L.

If the status at input Trg is 0 at least for the duration of the signal T_L, the output is set to 0 on expiration of the time T_L (the output follows the input with off-delay).

The time is reset when the signal at input Trg changes to 1 again before the time T_L has expired.

If retentivity is not set, output Q and the expired time are reset after a power failure.

4.4.4 Retentive on-delay

Short description

A one-shot at the input triggers a configurable on-delay time. The output is set when this time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the on-delay timer.
	Input R	A signal at input R resets the on-delay time and the output.
	Parameter	T represents the on-delay time for the output (output status transition 0 to 1). Retentivity: / = no retentivity R = The status is retentive.
	Output Q	Q is set after the time T has expired.

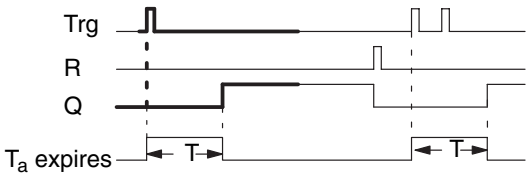
Parameter T

Note the defaults specified in Chapter 4.3.2.
The time for parameter T can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram



The bold section of the timing diagram is also shown in the symbol of the retentive on-delay.

Functional description

The 0 to 1 signal transition at input Trg triggers the current time T_a. Output Q is set when $T_a = T$. A further signal at input Trg does not influence the time T_a.

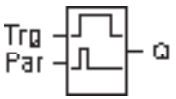
The output and the time T_a are reset with the next 1 signal at input R.

If retentivity is not set, output Q and the expired time are reset after a power failure.

4.4.5 Interval time-delay relay/Pulse output

Short description

An input pulse generates a signal with a configurable period at the output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the time for the wiping relay function.
	Parameter	The output is switched off after the time T has expired (output signal transition 1 to 0). Retentivity: / = No retentivity R = The status is retentive.
	Output Q	A signal at input Trg sets Q. If the input signal = 1, output Q remains set for the time Ta.

Parameter T

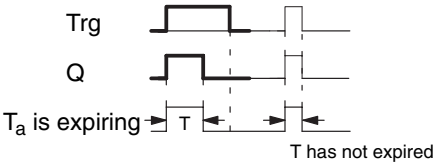
Note the information on parameter T in Chapter 4.3.2.

The time for parameter T can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram



The bold section of the timing diagram also appears in the symbol of the wiping relay.

Functional description

A 0 to 1 transition at input Trg sets the output, and triggers a time T_a during which the output remains set.

Output Q is reset to lo (pulse output) when T_a reaches the value preset at T (T_a = T).

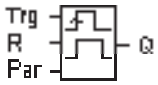
The output is immediately reset if there is a 1 to 0 transition at input Trg before the specified time has expired.

If retentivity is not set, output Q and the expired time are reset after a power failure.

4.4.6 Edge-triggered interval time-delay relay

Short description

An input pulse generates a preset number of output pulses with a defined pulse/pause ratio (retriggerable), after a configured delay time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the times for the edge-triggered interval time-delay relay.
	Input R	A signal at input R resets the current time (T_a) and the output.
	Parameter	The interpulse width T_L and the pulse width T_H are configurable. N determines the number of pulse/ pause cycles TL/TH: Range of values: 1...9 Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set after TL has expired, and reset after TH has expired.

Parameters TH and TL

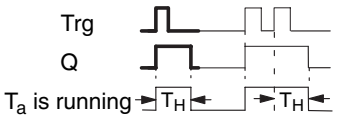
Note the information on parameter T in Chapter 4.3.2.

The pulse width TH and the interpulse width TL can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

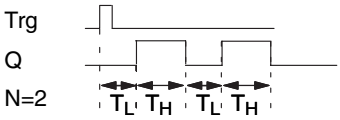
Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram A



The bold section of the timing diagram also appears in the symbol of the edge-triggered interval time-delay relay.

Timing diagram B



Timing diagram for the sample configuration

Functional description

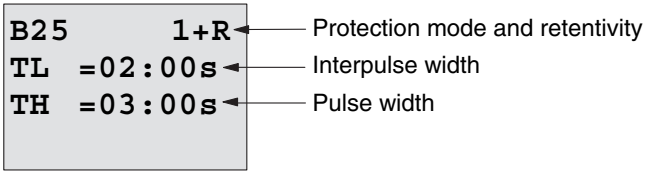
A 0 to 1 transition at input Trg triggers the time T_L (Time Low). After the time T_L has expired, output Q is set for the duration of T_H (Time High).

If there is a further 0 to 1 transition (retriggering pulse) at input Trg before the preset time ($T_L + T_H$) has expired, T_a is reset and the pulse/pause cycle is restarted.

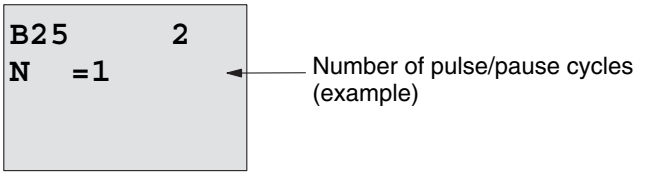
If retentivity is not set, output Q and the time are reset after a power failure.

Setting the Par parameter

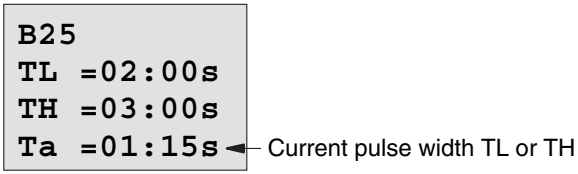
View in programming mode (example):



Press ▶



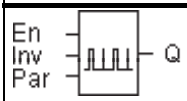
View in parameter assignment mode (example):



4.4.7 Asynchronous pulse generator

Short description

The output pulse shape can be modified by reconfiguring the pulse/pause ratio.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	You can use input EN to set and reset the asynchronous pulse generator.
	Input INV	Input INV can be used to invert the output signal of the active asynchronous pulse generator.
	Parameter	You can configure the pulse width T_H and the interpulse width T_L. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set and reset cyclically according to the pulse/pause ratio T_H and T_L.

Parameters TH and TL

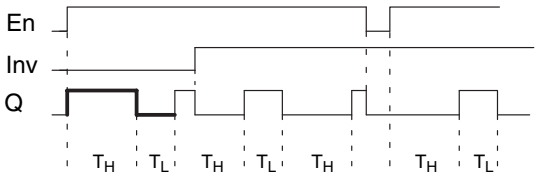
Note the information on parameter T in Chapter 4.3.2.

The pulse width TH and the interpulse width TL can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram



Functional description

You can configure the pulse/interpulse width at the T_H (Time High) and T_L (Time Low) parameters.

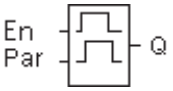
Input Inv can be used to invert the output signal, provided the block is enabled with a signal at input EN.

If retentivity is not set, output Q and the expired time are reset after a power failure.

4.4.8 Random generator

Short description

The output of the random generator is set or reset within a configured time.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A positive edge (0 to 1 transition) at input En (Enable) triggers the on-delay time of the random generator. A negative edge (1 to 0 transition) at input En (Enable) triggers the off-delay time of the random generator.
	Parameter	The on-delay is set at random to a value between 0 s and T_H. The off-delay is set at random to a value between 0 s and T_L.
	Output Q	Output Q is set when the on-delay has expired and if En is still set. It is reset when the off-delay has expired, provided En was not set again meanwhile.

Parameter T_H and T_L

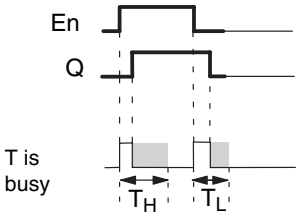
Note the defaults of the T_H and T_L parameters listed in Chapter 4.3.2.

The on-delay time TH and the off-delay time TL can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram



The bold section of the timing diagram also appears in the symbol of the random generator.

Functional description

The 0 to 1 transition at input En triggers a random on-delay time between 0 s and T_H. The output is set when the on-delay time has expired and if the signal at input En remains hi at least for the duration of this time.

The time is reset if input En is reset before the on-delay time has expired.

A 1 to 0 transition at input EN triggers a random off-delay time between 0 s and T_L.

The output is reset after the off-delay time has expired, provided input En remains lo at least for the duration of this time.

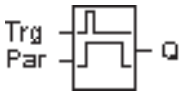
The time is reset if the signal at input En changes to 1 again before the off-delay time has expired.

The time expired is reset after a power failure.

4.4.9 Stairwell Light Switch

Short description

An input edge triggers a configurable and retriggerable time. The output is reset after this time has expired. A warning signal can be output before this time has expired to warn of the impending shutdown.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the off-delay time for the stairwell Light Switch.
	Parameter	T represents the off-delay time of the output (output signal transition 1 to 0). $T_!$ determines the triggering time for the pre-warning. $T_{!L}$ determines the length of the pre-warning signal. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is reset after the time T has expired. A warning signal can be output before this time has expired.

Parameter T, $T_!$ and $T_{!L}$

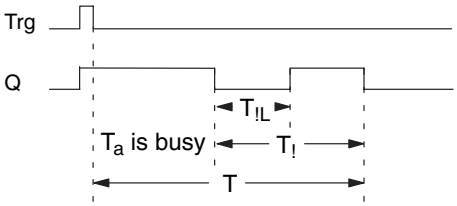
Note the defaults of the T parameters listed in Chapter 4.3.2.

The off-delay time T, the pre-warning time $T_!$ and the pre-warning period $T_{!L}$ can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram



Functional description

A 0 to 1 signal transition at input Trg sets output Q. The next 1 to 0 transition at Trg retriggers the current time T_a, and output Q remains set.

Output Q is reset when $T_a = T$. You can output a warning signal before the off-delay time ($T - T_!$) has expired to reset Q for the time of the pre-warning period $T_{!L}$.

A further one-shot at input Trg during T_a retriggers the time T_a .

If retentivity is not set, output Q and the expired time are reset after a power failure.

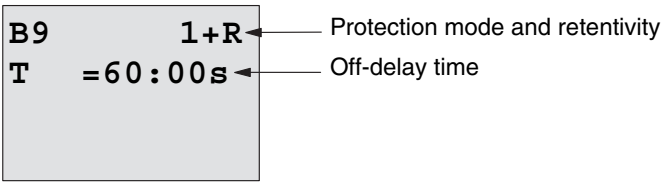
Setting the Par parameter

Note the defaults specified in Chapter 4.3.2.

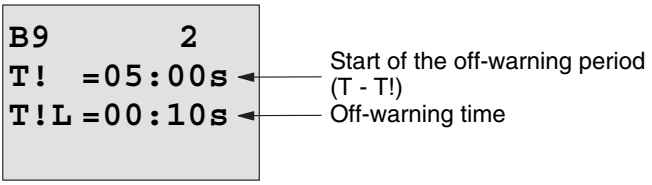
Note

All times must have the same timebase.

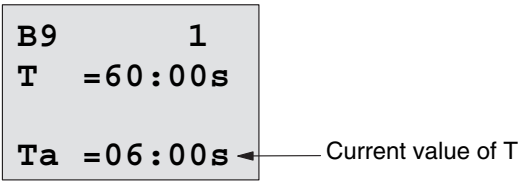
View in programming mode (example):



Press ▶



View in parameter assignment mode (example):

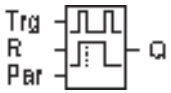


4.4.10 Dual-function switch

Short description

Switch with two different functions:

- Pulse switch with off-delay
- Switch (permanent lighting)

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) sets output Q (permanent light) or resets Q with an off-delay. When active, output Q can be reset with a signal at input Trg.
	Input R	A signal at input R resets the current time T_a and resets the output.
	Parameter	T represents the off-delay time. The output is reset (1 to 0 transition) when time T expires. T_L represents the time during which the output must be set to enable the permanent light function. $T_!$ represents the on-delay for the prewarning time. $T_{!L}$ represents the length of the prewarning time period. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	A signal at Trg switches on output Q. Depending on the length of the input at Trg, the output is switched off again or switched on permanently, or it is reset with a further signal at Trg.

Parameters T, T_L, $T_!$ and $T_{!L}$

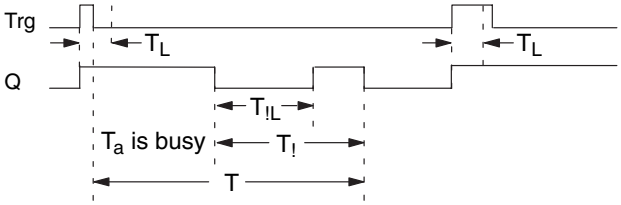
Note the defaults of the T parameters listed in Chapter 4.3.2.

The off-delay time T, the permanent light time T_L, the on-delay prewarning time $T_!$ and the prewarning time period $T_{!L}$ can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram



Functional description

A 0 to 1 transition at input Trg sets output Q.

If output Q = 0, and input Trg is set hi at least for the duration of T_L, the permanent lighting function is enabled and output Q is set accordingly.

The off-delay T is triggered when input Trg returns to 0 before T_L has expired.

Output Q is reset when $T_a = T$.

You can output an off-warning signal prior to the expiration of the off-delay time (T - $T_!$) that resets Q for the duration of the prewarning time period $T_{!L}$. A subsequent signal at Trg always resets T and the output Q.

If retentivity is not set, output Q and the expired time are reset after a power failure.

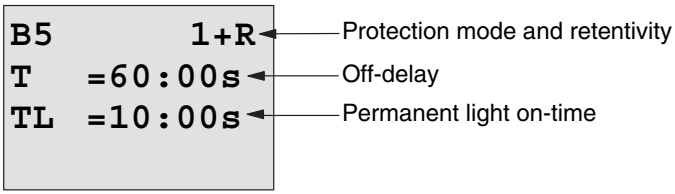
Setting the Par parameter

Note the defaults specified in Chapter 4.3.2.

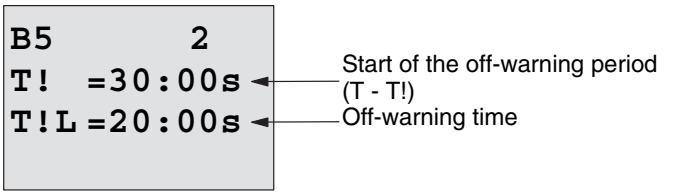
Note

T, $T_!$ and $T_{!L}$ must all have the same timebase.

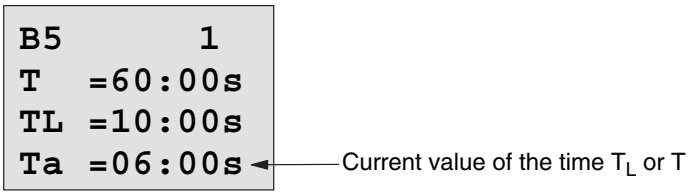
View in programming mode (example):



Press ▶



View in parameter assignment mode (example):



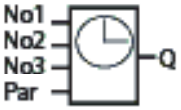
4.4.11 Seven-day time switch

Short description

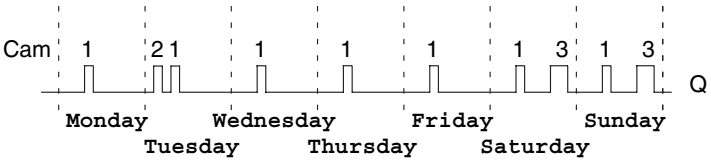
The output is controlled by means of a configurable on/off date. The function supports any combination of weekdays. You select the active weekdays by hiding the inactive days.

Note

Because FL1E-H12SND (version 4 or earlier) does not have a real-time clock, the seven-day time switch function is not available for the version. For identifying the version, see page 5.

Symbol in IDEC SmartRelay	Wiring	Description
	Cam parameters 1, 2, and 3	At the Cam parameters, you set the on- and off-times of the seven-day time switch for each **Cam** switch. Here you also configure the days and the time-of-day.
	Par	You specify whether the timer pulses on for one cycle when activated and then reset. The pulse setting applies to all three cams.
	Output Q	Q is set when the configured cam is actuated.

Timing diagram (three examples)



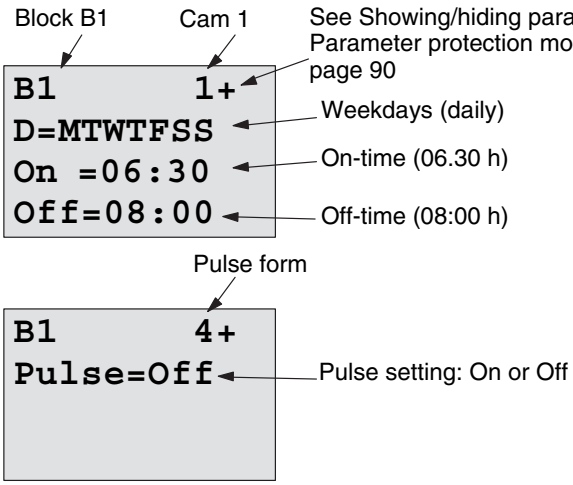
Cam 1: Daily : 06:30 h to 8:00 h
Cam 2: Tuesday : 03:10 h to 04:15 h
Cam 3: Saturday and Sunday : 16:30 h to 23:10 h

Functional description

Each seven-day time switch has three cams you can use to configure a time hysteresis. You specify the on- and off-times at the Cam parameters. The seven-day time switch sets the output at a certain on-time, if this is not already set. The seven-day time switch resets the output at a certain off-time if you configured an off-time, or at the end of the cycle if you specified a pulse output. You will cause a conflict if the on- and off-times you set for the seven-day time switch are identical, though set on different cams. In this case, cam3 takes priority over cam2, whereas cam2 takes priority over cam1.
The switching state of the seven-day time switch is determined by the status of all three cams.

Parameter assignment screen form

View of the parameter assignment screen form, for example for Cam1 and the Pulse setting:



Days of the week

The suffix of ”D=” (Day) has the following meaning:

- M : Monday
- T : Tuesday
- W : Wednesday
- T : Thursday
- F : Friday
- S : Saturday
- S : Sunday

Uppercase letters indicate a specific day of the week. A “-” indicates no selection for the day of the week.

On-/Off-times

Any time between 00:00 h and 23:59 h is possible.You can also configure the on time to be a pulse signal. The timer block will be activated at the specified time for one cycle and then the output is reset.
- -:- - means: No on-/off-times set.

Setting the seven-day time switch

To set the on-/off-times:

1. Move the cursor to one of the Cam parameters of the timer (e.g. No1).
2. Press **OK**. IDEC SmartRelay opens the Cam parameter assignment screen form. The cursor is positioned on the weekday.
3. Press ▲ and ▼ to select one or several days of the week.
4. Press ▶ to move the cursor to the first position of the on-time.
5. Set the on-time.
   Modify the value at the respective position, using the keys ▲ and ▼. Move to the cursor to the various positions, using the keys ◀ and ▶. At the first position, you can only select the value - -:- -
   (- -:- - means: No on-/off-times set).
6. Press ▶ to move the cursor to the first position of the off-time.
7. Set the off-time (in same way as in step 5).
8. Confirm your entries with **OK**.

The cursor is now positioned on the No2 parameter (Cam2) and you can configure a further cam.

Note

For information on timer accuracy, refer to the technical data and to Chapter 4.3.2.

Seven-day time switch: Example

The output of the seven-day time switch switch is to be set daily from 06:30 h to 08:00 h. The output should also be set every Tuesday from 03:10 h to 04:15 h, and on the weekends from 16:30 h to 23:10 h.

This requires three cams.

Here are the parameter assignment screen forms of the cams No 1, 2 and 3, based on the timing diagram shown earlier.

Cam1

Cam No1 must set the output of the seven-day time switch daily from 06:30 h to 08:00 h.

```
B1      1+
D=MTWTFSS
On =06:30
Off=08:00
```

Cam2

Cam No2 must set the output of the seven-day time switch every Tuesday from 03:10 h to 04:15 h.

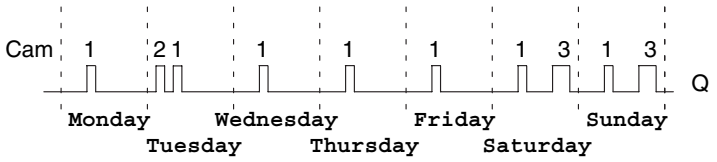
```
B1      2
D=-T-----
On =03:10
Off=04:15
```

Cam3

Cam No3 must set the output of the seven-day time switch switch every Saturday and Sunday from 16:30 h to 23:10 h.

```
B1      3
D=-----SS
On =16:30
Off=23:10
```

Result



4.4.12 Twelve-month time switch

Short description

The output is controlled by means of a configurable on/off date. You can configure the timer to activate on a yearly, monthly, or user-defined time basis. With any mode, you can also configure the timer to pulse the output during the defined time period. The time period is configurable within the date range of January 1, 2000 to December 31, 2099

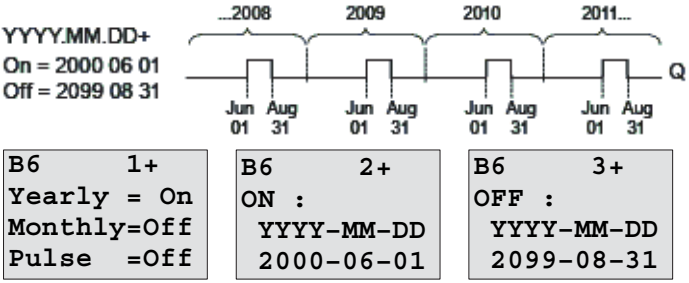
Note

Because FL1E-H12SND (version 4 or earlier) does not have a real-time clock, the twelve-month time switch function is not available for the version. For identifying the version, see page 5.

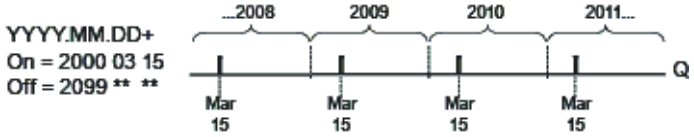
Symbol in IDEC SmartRelay	Wiring	Description
	Cam parameter	At the Cam parameter, you configure the timer mode, the on-/off-times for the timer, and whether the output is a pulse output.
	Output Q	Q is set when the configured cam is switched on.

Timing diagrams

Example 1: Yearly mode on, Monthly mode off, Pulse Off, On Time = 2000–06–01, Off Time = 2099–08–31: Every year on June 1 the timer output switches on and remains on until August 31.



Example 2: Yearly mode on, Monthly mode off, Pulse on, On Time = 2000–03–15, Off Time = 2099–**–**: Every year on March 15, the timer switches on for one cycle.

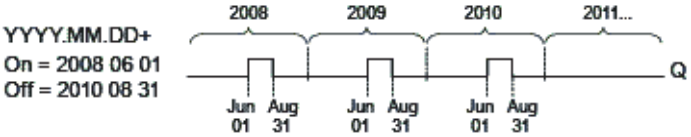



```
B6      1+
Yearly = On
Monthly=Off
Pulse  = On
```

```
B6      2+
ON :
 YYYY-MM-DD
 2000-03-15
```

```
B6      3+
OFF :
 YYYY-MM-DD
 2099-**-**
```

Example 3: Yearly mode on, Monthly mode off, Pulse off, On Time = 2008–06–01, Off Time = 2010–08–31: On June 1 of 2008, 2009, and 2010 the timer output switches on and remains on until August 31.




```
B6      1+
Yearly = On
Monthly=Off
Pulse  =Off
```

```
B6      2+
ON :
 YYYY-MM-DD
 2008-06-01
```

```
B6      3+
OFF :
 YYYY-MM-DD
 2010-08-31
```

Example 4: Yearly mode on, Monthly mode off, Pulse on, On Time = 2008–03–15, Off Time = 2010–**–**: On March 15 of 2008, 2009, and 2010, the timer output switches on for one cycle.

```
B6      1+
Yearly = On
Monthly=Off
Pulse  = On
```

```
B6      2+
ON :
 YYYY-MM-DD
 2008-03-15
```

```
B6      3+
OFF :
 YYYY-MM-DD
 2010-**-**
```

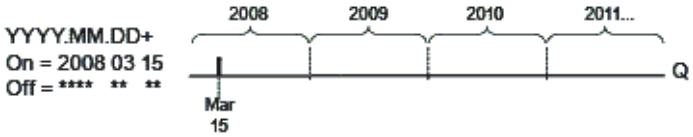
Example 5: Yearly mode off, Monthly mode off, Pulse off, On Time = 2008–06–01, Off Time = 2008–08–31: On June 1, 2008 the timer output switches on and remains on until August 31, 2010.

```
B6      1+
Yearly =Off
Monthly=Off
Pulse  =Off
```

```
B6      2+
ON :
 YYYY-MM-DD
 2008-06-01
```

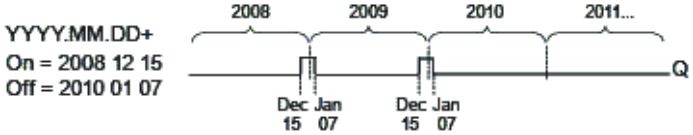
```
B6      3+
OFF :
 YYYY-MM-DD
 2010-08-31
```

Example 6: Yearly mode off, Monthly mode off, Pulse selected, On Time = 2008–03–15, Off Time = ****–**–**: On March 15, 2008 the timer output switches on for one cycle. Because the timer does not have a monthly action or yearly action, the timer output pulses only one time at the specified On Time.



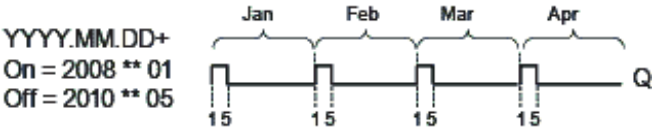
B6 1+	B6 2+	B6 3+
Yearly =Off	ON :	OFF :
Monthly=Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =On	2008-03-15	****-**-**

Example 7: Yearly mode on, Monthly mode off, Pulse off, On Time = 2008–12–15, Off Time = 2010–01–07: On December 15 of 2008 and 2009, the timer output switches on and remains on until January 7 of the following year. When the timer output turns off on January 7, 2010 it does NOT turn on again the following December 15.



B6 1+	B6 2+	B6 3+
Yearly = On	ON :	OFF :
Monthly=Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =Off	2008-12-15	2010-01-07

Example 8: Yearly mode on, Monthly mode on, On Time = 2008–**–01, Off Time = 2010–**–05: Starting in 2008, on the first day of each month the timer output switches on and switches off on the fifth day of the month. The timer continues in this pattern through the last month of 2010.




```
B6     1+
Yearly =On
Monthly=On
Pulse  =Off
```

```
B6     2+
ON :
 YYYY-MM-DD
 2008-**-01
```

```
B6     3+
OFF :
 YYYY-MM-DD
 2010-**-05
```

Functional description

The twelve-month time switch sets and resets the output at specific on and off dates. Sets and resets are executed at 00:00. If your application requires a different time, use a seven-day time switch together with a twelve-month time switch in your circuit program.

The on time specifies when the timer is activated. The off time specifies when the output is reset again. For the on and off times, note the order of the fields: The first field defines the year, the second the month and the third the day.

If you set the Monthly mode on, the timer output switches on each month at the specified day of the on time and remains on until the specified day of the off time. The on time specifies the initial year in which the timer is activated. The off time defines the last year in which the timer turns off. The maximum year is 2099.

If you set the Yearly mode on, the timer output switches on each year at the specified month and day of the on time and remains on until the specified month and day of the off time. The on time specifies the initial year in which the timer is activated. The off time defines the last year in which the timer turns off. The maximum year is 2099.

If you set Pulse output, the timer output switches on at the specified on time for one cycle and then the timer output is reset. You can choose to pulse a timer on a monthly or yearly basis, or just a single time.

If you set none of the Monthly, Yearly, or Pulse modes on, you can define a specific time period with the on time and off time. It can span any time period that you choose.

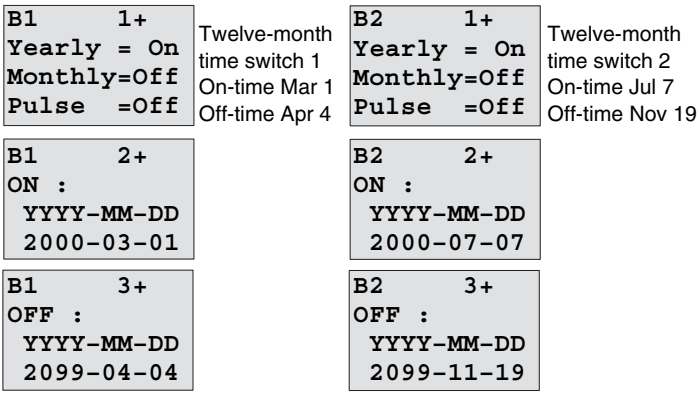
For a process action that is to be switched on and off at multiple but irregular times during the year, you can define multiple twelve-month time switches with the outputs connected by an OR function block.

Backup of the real-time clock

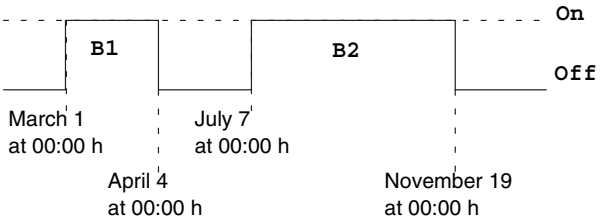
The internal real-time clock of IDEC SmartRelay is buffered against power failure. The buffering time is influenced by the ambient temperature, and is typically 80 hours at an ambient temperature of 25°C. If you are using the optional IDEC SmartRelay Battery cartridge, or combined IDEC SmartRelay Memory/Battery cartridge, IDEC SmartRelay can retain the clock time for up to two years. To backup the real time clock for more than 80 hours, insert a battery cartridge or a combined memory/battery cartridge to the base module.

Sample configuration

The output of an IDEC SmartRelay is to be set annually on March 1, reset on April 4, set again on July 7, and reset again on November 19. You need to configure two twelve-month time switches with corresponding on-times. Then logically link the outputs by means of an OR block.



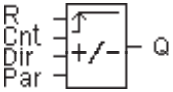
Result



4.4.13 Up/down counter

Short description

An input pulse increments or decrements an internal value, depending on the parameter setting. The output is set or reset when a configured threshold is reached. The direction of count can be changed with a signal at input Dir.

Symbol in IDEC SmartRelay	Wiring	Description
	Input R	A signal at input R resets the internal count value to zero.
	Input Cnt	The function counts the 0 to 1 transitions at input Cnt. 1 to 0 transitions are not counted. Use • inputs I3, I4, I5, and I6 for fast counting (only FL1E-H12RCE/ FL1E-B12RCE and FL1E-H12SND): max. 5 kHz. • any other input or circuit component for counting low frequency signals (typ. 4 Hz).
	Input Dir	You set the direction of count at input Dir: Dir = 0: Up count Dir = 1: Down count
	Parameter	On: On threshold Range of values: 0...999999 Off: Off threshold Range of values: 0...999999 StartVal: Initial value from which to begin counting either down or up. Retentivity for internal counter value Cnt: / = No retentivity R = The status is retentive.
	Output Q	Q is set or reset, depending on the current value at Cnt and the set thresholds.

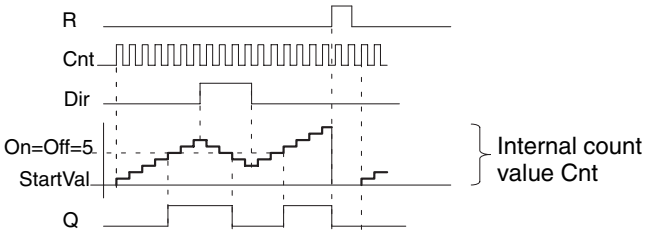
Parameters On and Off

The on threshold On and the off threshold Off can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number.

Timing diagram



Functional description

The internal counter increments (Dir = 0) or decrements (Dir = 1) by one count with every positive edge at input Cnt.

You can use input R to reset the internal count value to the start value. As long as R = 1, the output is also 0 and the pulses at input Cnt are not counted.

If retentivity is not set, output Q and the expired time are reset after a power failure.

Q is set or reset depending on the current value at Cnt and the set thresholds. See the calculation rule below.

Calculation rule

- If the On threshold ≥ Off threshold, then:
  Q = 1, if Cnt ≥ On
  Q = 0, if Cnt < Off.
- If the On threshold < Off threshold, then Q = 1,
  if On ≤ Cnt < Off.

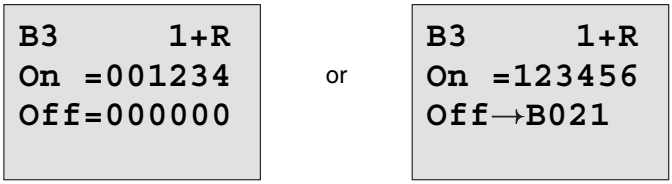
Note

The system scans the counter limit value cyclically.

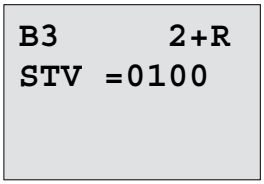
Thus, if the pulse frequency at the fast inputs I3, I4, I5 or I6 is faster than the cycle time, the special function might not switch until after the specified limit value is exceeded

Example: Up to 100 pulses per cycle can be counted; 900 pulses have been counted so far. On = 950; Off = 10000. The output is set in the next cycle, after the value has reached 1000. (The output would not be set at all if the value Off = 980.)

View in programming mode (example):

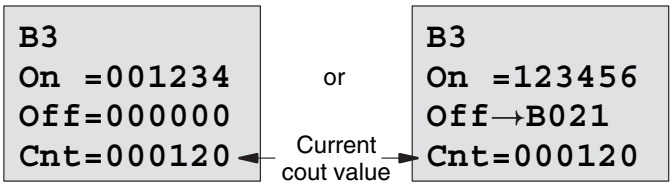


To set the start value, press ▲ or ▼ to access the following screen form:



If the referenced block (B021, in the example) returns a value that lies out of the valid range, the value is rounded to the next valid value.

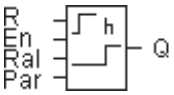
The view in parameter assignment mode (example):



4.4.14 Operating hours counter

Short description

A configured time is triggered with a signal at the monitoring input. The output is set when this time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input R	A positive edge (0 to 1 transition) at input R resets output Q and sets a configured value MI at the counter for the duration of the time-to-go (MN).
	Input En	En is the monitoring input. IDEC SmartRelay scans the on-time of this input.
	Input Ral	A positive edge at input Ral (Reset all) resets the operating hours counter (OT) and the output, and sets the time-to-go value (MN) tothe maintenance interval MI: • output Q = 0, • measured operating time OT = 0 and • the time-to-go of the maintenance interval MN = MI.
	Parameter	MI : Maintenance interval to be preset in units of hours and minutes Range of values: 0000...9999 h, 0...59 m OT : The accumulated total operating time; you can specify an offset in hours and minutes Range of values: 00000...99999 h, 0...59 m Q→0: • Whenv ”R” is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 • When ”R+En” is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 or En = 0.
	Output Q	The output is set when the time-to-go MN = 0 (see timing diagramm). The output is reset: • When ”Q→0:R+En”, if R = 1 or Ral = 1 or En = 0 • When ”Q→0:R”, if R = 1 or Ral = 1.

MI = Configured time interval
MN = Time-to-go
OT = Total time expired since the last hi signal at input Ral
These values are always retentive!

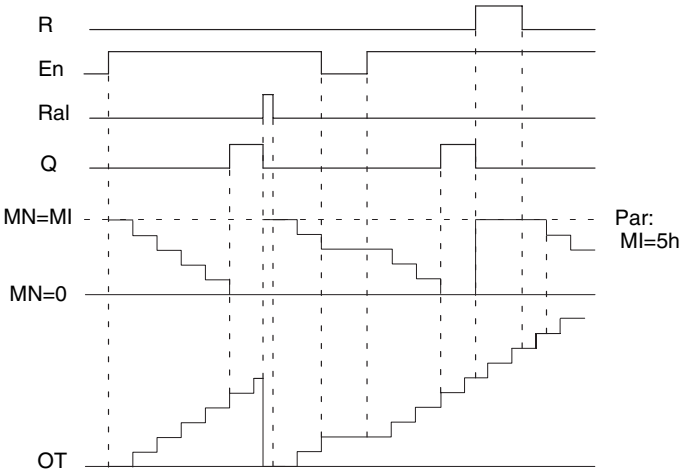
Parameter MI

The maintenance interval MI can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number.

Timing diagram



MI = Configured time interval
MN = Time-to-go
OT = Total time expired since the last hi signal at input Ral

Functional description

The operating hours counter monitors input En. When En = 1, IDEC SmartRelay computes the time expired and the time-to-go MN. IDEC SmartRelay shows these times in parameter assignment mode. Output Q is set when the time-to-go MN = 0.

A signal at reset input R resets output Q and sets the preset value of MI at the counter for the duration of MN. The operating hours counter OT is not affected.

With a signal at the reset input Ral, you reset output Q and set the preset value of MI at the counter for the duration of MN. The operating hours counter OT is reset to zero.

Depending on your configuration of parameter Q, the output is either reset with a signal at input
R or Ral ("Q→0:R"), or when a reset signal is set hi, or the En signal is set lo ("Q→0:R+En").

Viewing the MI, MN and OT values

In WindLGC you can fetch the hours counter via the "Tools -> Transfer: Hours counter" menu command.

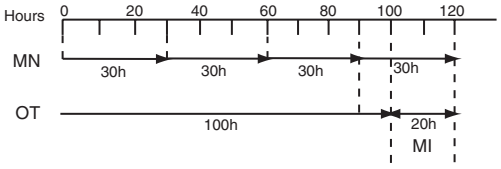
Limit value of OT

The value of the operating hours in OT are retained when you reset the hours counter with a signal at input R. The hours counter OT will be reset to zero with a transition from 0 to 1 at Ral. The hours counter OT continues the count as long as En = 1, irrespective of the status at the reset input R. The counter limit of OT is 99999 h. The hours counter stops when it reaches this value.

In programming mode, you can set the initial value of OT. MN is calculated according to the following formula when reset input R never enabled: MN = MI - (OT % MI).

Example:

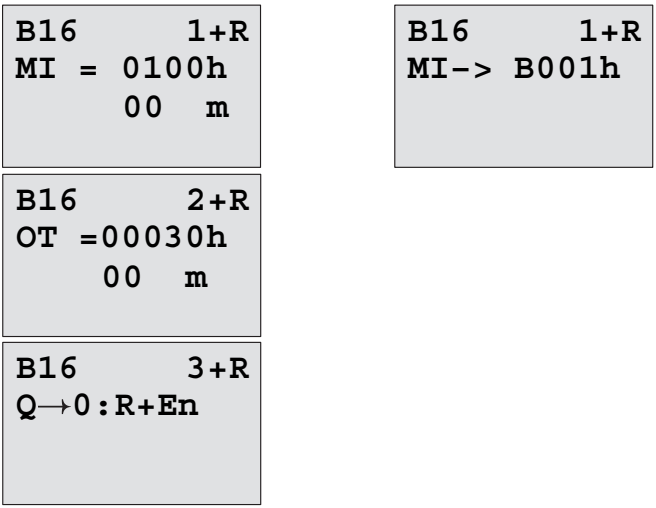
MI = 30h, OT = 100h
MN = 30 - (100 % 30)
MN = 30 -10
MN = 20h



In runtime mode, the value OT can not be preset. If the value for MI is changed, there would be no calculation for the MN. MN will take on the value of MI.

Setting the Par parameter

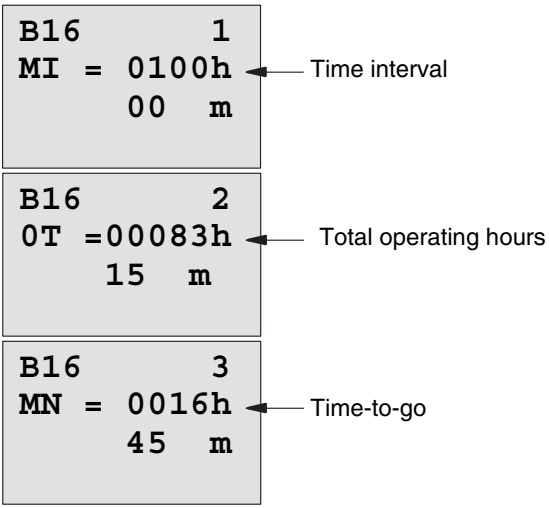
View in programming mode:



MI is the configurable time interval. The permissible range of values is 0 to 9999 hours.

For information on how to assign the actual value of another already-programmed function to a parameter, see section 4.4.1

View in parameter assignment mode:



4.4.15 Frequency trigger

Short description

The output is set and reset with two configurable frequency triggers.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Fre	The function counts the 0 to 1 transitions at input Fre. 1 to 0 transitions are not counted. Use • inputs I3, I4, I5, I6 for fast counting (only FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND): max. 5 kHz. • any other input or circuit component for counting low frequency signals (typ. 4 Hz).
	Parameter	On : On threshold Range of values: 0000...9999 Off : Off threshold Range of values: 0000...9999 G_T : Time interval or gate time during which the input pulses are measured. Range of values: 00:05 s...99:99 s
	Output Q	Q is set and reset at the thresholds.

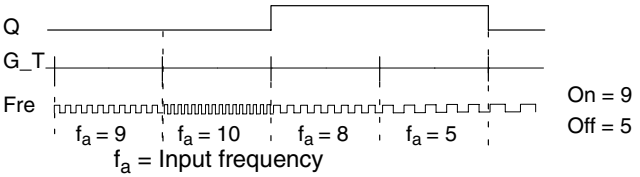
Parameter G_T

The gate time G_T can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number.

Timing diagram



Functional description

The frequency trigger measures the signals at input Fre. The pulses are recorded across a configurable time G_T.

Output Q is set and reset in accordance with the set thresholds. See the calculation rule below.

Calculation rule

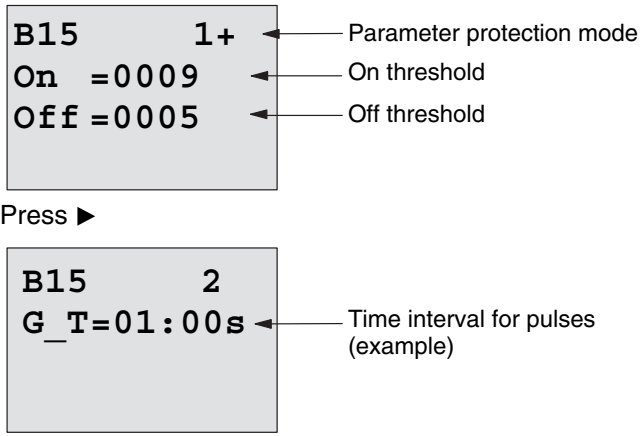
- If the On threshold ≥ Off threshold, then:
  Q = 1, if f_a > On
  Q = 0, if f_a ≦ Off.
- If the On threshold < Off threshold, then:
  Q = 1, if On ≦ f_a < Off.

Setting the Par parameter

Note

The system scans the counter limit value once per interval G_T.

View in programming mode (example):

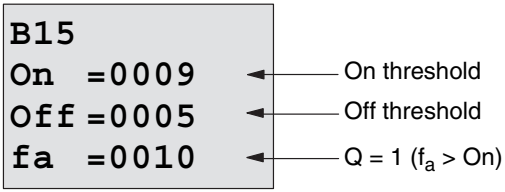


Note

The “seconds” timebase is here set as permanent default.

When you preset a time G_T of 1 s, IDEC SmartRelay returns the current frequency in parameter f_a in Hz.

View in parameter assignment mode (example):



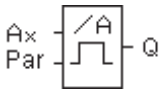
Note

f_a always represents the total pulses measured per time unit G_T.

4.4.16 Analog trigger

Short description

The output is set and reset at two configurable thresholds.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Ax	You apply the analog signal to be analyzed at input Ax. Use the analog inputs AI1...AI8 (*), the analog memory markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2.
	Parameter	A: Gain Range of values: ±10.00 B: Zero offset Range of values: ±10,000 On: On threshold Range of values: ±20,000 Off: Off threshold Range of values: ±20,000 p: Number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set or reset by the Frequency triggers.

* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).

Gain and offset parameters

Please note the information on gain and offset parameters in Chapter 4.3.6.

Parameters On and Off

The On and Off parameters can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

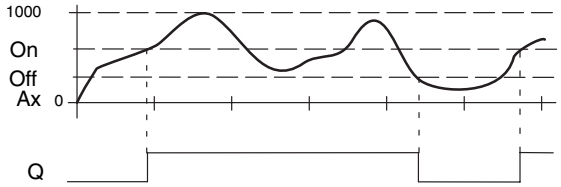
- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number.

Parameter p (number of decimals)

Does not apply to the display of On, Off and Ax values in a message text.
Does not apply to the comparison of On and Off values! (The compare function ignores the decimal point.)

Timing diagram



Functional description

The function fetches the analog signal at input Ax.

Ax is multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is added to product, i.e. (Ax•gain) + offset = actual value of Ax.

Output Q is set or reset, depending on the set thresholds. See the calculation rule below.

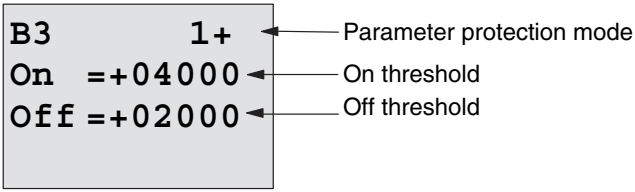
Calculation rule

- If the On threshold ≥ Off threshold, then:
  Q = 1, if the actual value Ax > On
  Q = 0, if the actual value Ax ≤ Off.
- If the On threshold < Off threshold, then Q = 1 if
  On ≤ actual value Ax < Off.

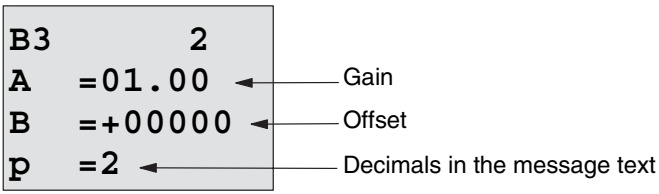
Setting the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

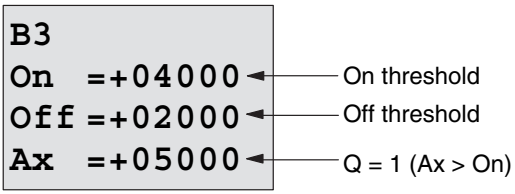
View in programming mode (example):



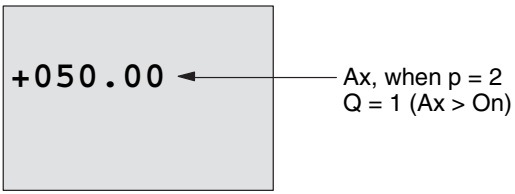
Press ▶



View in parameter assignment mode (example):



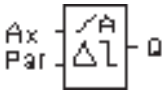
View in the message text (example):



4.4.17 Analog differential trigger

Short description

The output is set and reset depending on a configurable threshold and a differential value.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Ax	You apply the analog signal to be analyzed at input Ax. Use the analog inputs AI1...AI8 (*), the analog memory markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2.
	Parameter	A: Gain Range of values: ±10.00 B: Zero offset Range of values: ±10,000 On: On/Off threshold Range of values: ±20,000 Δ: Differential value for calculating the off parameter Range of values: ±20,000 p: Number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set or reset, depending on the threshold and difference values.

* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).

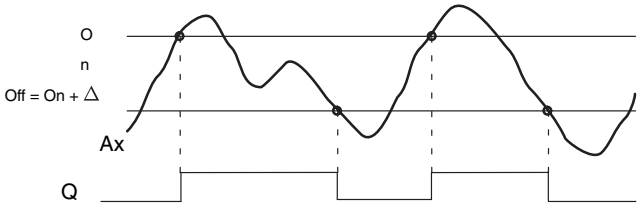
Gain and offset parameters

Please note the information on gain and offset parameters in Chapter 4.3.6.

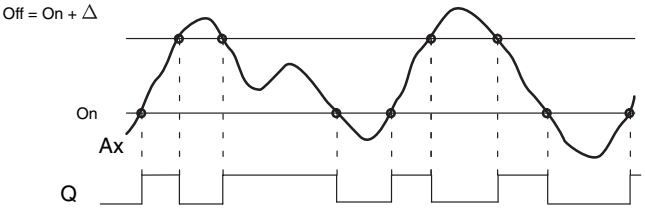
Parameter p (number of decimals)

Does not apply to the display of On, Off and Ax values in a message text.

Timing diagram A: Function with negative difference Δ



Timing diagram B: Function with positive difference Δ



Functional description

The function fetches the analog signal at input Ax.

Ax is multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is added to product, i.e. (Ax•gain) + offset = actual value of Ax.

Output Q is set or reset, depending on the set (On) thresold and difference value (Δ). The function automatically calculates the Off parameter: Off = On + Δ, whereby Δ may be positive or negative. See the calculation rule below.

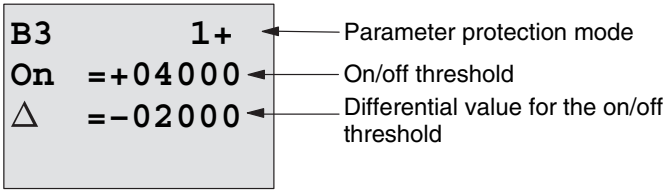
Calculation rule

- When you set a negative differential value Δ, the On threshold ≥ Off threshold, and:
  Q = 1, if the actual value Ax > On
  Q = 0, if the actual value Ax ≤ Off.
  See the timing diagram A.
- When you set a positive differential value Δ, the On threshold < the Off threshold, and Q = 1, if:
  On ≤ actual value Ax < Off.
  See the timing diagram B.

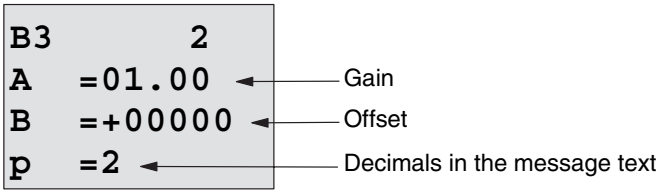
Setting the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

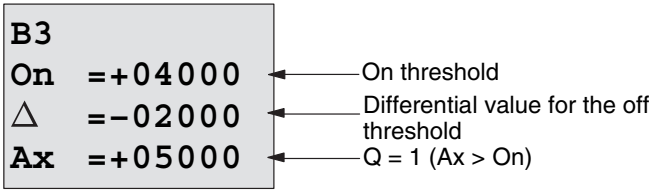
View in programming mode (example):



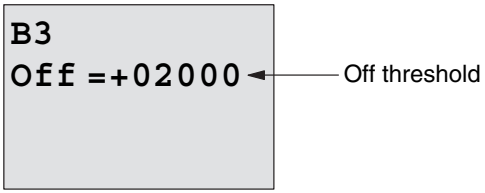
Press ▶



View in parameter assignment mode (example):



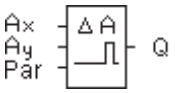
Press ▼



4.4.18 Analog comparator

Short description

The output is set and reset depending on the difference Ax - Ay and on two configurable thresholds.

Symbol in IDEC SmartRelay	Wiring	Description
	Inputs Ax and Ay	You apply the analog signals the difference of which you want to analyze at the inputs Ax and Ay. Use the analog inputs AI1...AI8 (*), the analog memory markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2.
	Parameter	A: Gain Range of values: ±10.00 B: Zero offset Range of values: ±10,000 On: On threshold Range of values: ±20,000 Off: Off threshold Range of values: ±20,000 p: Number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set or reset, depending on the difference Ax - Ay and the set thresholds.

* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).

Gain and offset parameters

For more information on the gain and offset parameters, refer to Chapter 4.3.6.

Parameters On and Off

The on threshold On and the off threshold Off can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

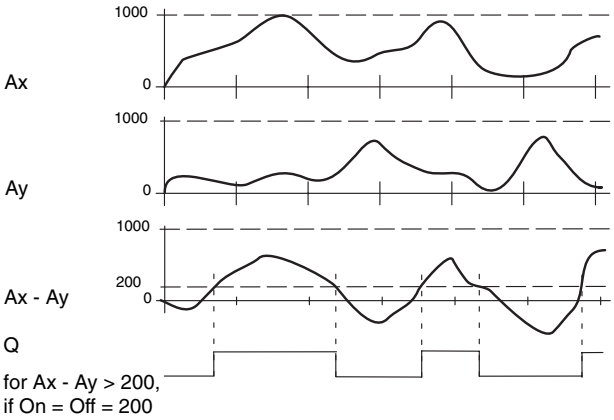
- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number.

Parameter p (number of decimals)

Does not apply to Ax, Ay, On, Off and Δ values displayed in a message text.
Does not apply to the comparison of on and off values! (The compare function ignores the decimal point.)

Timing diagram



Functional description

The function fetches the analog values from the inputs Ax and Ay.

Ax and Ay are each multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is then added to the relevant product, i.e.
(Ax•gain) + offset = actual value Ax or
(Ay•gain) + offset = actual value Ay.

The function forms the difference ("Δ") between the actual values Ax - Ay.

Output Q is set or reset, depending on difference of the actual values Ax - Ay and the set thresholds. See the calculation rule below.

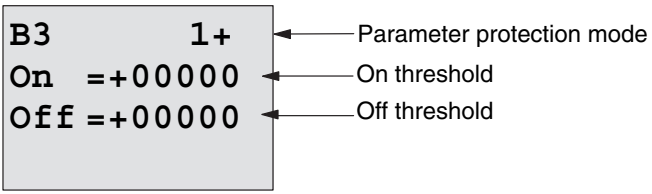
Calculation rule

- If the On threshold ≥ Off threshold, then:
  Q = 1, if:
  (actual value Ax - actual value Ay) > On
  Q = 0, if:
  (actual value Ax - actual value Ay) ≤ Off.
- If the On threshold < Off threshold, then Q = 1, if:
  On ≤ (actual value Ax - actual value Ay) < Off.

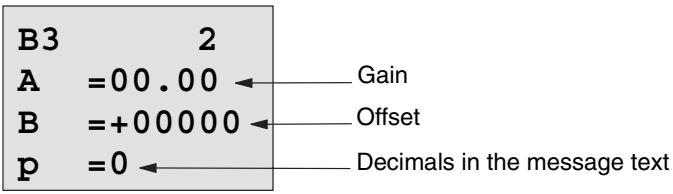
Setting the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

View in programming mode:



Press ▶



Example

In a heating control system, the supply T_v and return line temperatures T_r are to be compared, for example with a sensor at AI2.

A control signal is to be triggered (for example ”heater On”) when the difference between the supply and return line temperatures is greater than 15°. The control signal is reset when the difference is less than 5°C.

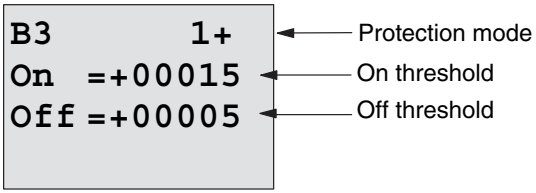
The process variable of the temperature is to be shown in parameter assignment mode.

The thermocouples available have the the following technical data: -30 to +70°C, 0 to 10 VDC.

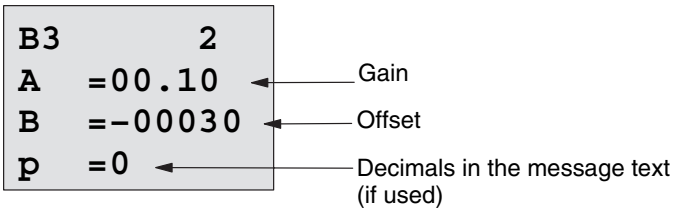
Application	Internal mapping
-30 to +70 °C = 0 to 10 V DC	0 to 1000
0 °C	300 → Offset = -30
Range of values: -30 to +70 °C = 100	1000 → Gain = 100/1000 = 0.1
On threshold = 15 °C	Threshold = 15
Off threshold = 5 °C	Threshold = 5

See also Chapter 4.3.6.

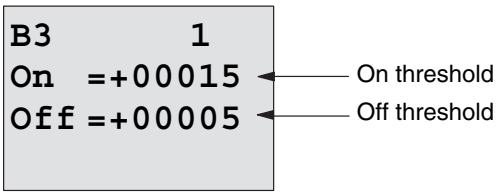
Configuration (example):



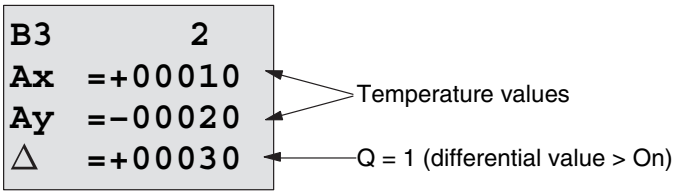
Press ▶



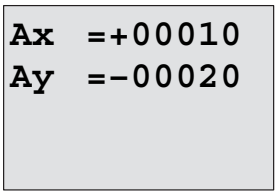
View in parameter assignment mode (example):



Press ▼



View in the message text (example):

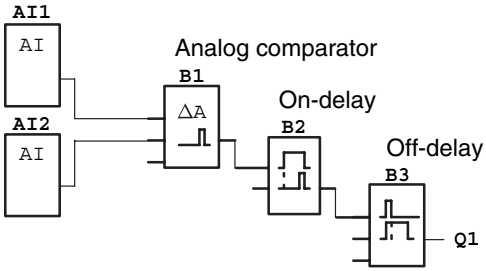


Reducing the input response of the analog comparator

You can selectively delay the output of an analog comparator by means of the ”On-delay” and ”Off-delay” special functions. With on-delay, output Q is only set if the pulse width of the triggering signal at input Trg (=analog comparator output) is longer than the on-delay time.

Using this method, you will obtain a virtual hysteresis and reduce the input response to short signals.

Function block diagram



4.4.19 Analog watchdog

Short description

This special function saves the process variable of an analog input to memory, and sets the output when the output variable exceeds or drops below this stored value plus a configurable offset.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A positive edge (0 to 1 transition) at input En saves the analog value at input Ax ("Aen") to memory and starts monitoring of the analog range Aen - Δ_2 to Aen+ Δ_1
	Input Ax	You apply the analog signal to be monitored at input Ax. Use the analog inputs AI1...AI8 (*), the analog memory markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2.
	Parameter	A: Gain Range of values: ±10.00 B: Zero offset Range of values: ±10,000 Δ_1: Difference value above Aen: on/off threshold Range of values: 0-20,000 Δ_2: Difference value below Aen: on/off threshold Range of values: 0-20,000 p: Number of decimals Range of values: 0, 1, 2, 3 Retentivity: / = No retentivity R = The status is retentive in memory
	Output Q	Q is set/reset, depending on the stored analog value and the offset.

* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).

Gain and offset parameters

For more information on gain and offset parameters, refer to Chapter 4.3.6.

Parameters Delta1 and Delta2

The Delta1 and Delta2 parameters can be provided by the actual value of another already-programmed function. You can use the actual value of the following functions:

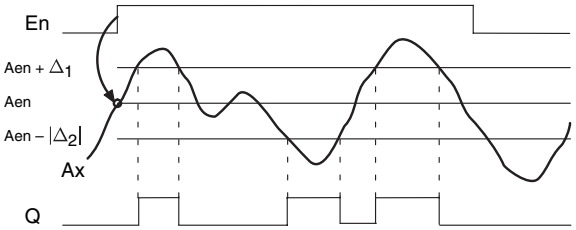
- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number.

Parameter p (number of decimals)

Applies only to the Aen, Ax, Δ_1 and Δ_2 values displayed in a message text.

Timing diagram



Functional description

A 0 to 1 transition at input En saves the value of the signal at the analog input Ax. This saved process variable is referred to as ”Aen”.

Both the analog actual values Ax and Aen are multiplied by the value at parameter A (gain), and parameter B (offset) is then added to the product:
(Ax•gain) + offset = Actual value Aen, when input En changes from 0 to 1, or
(Ax•gain) + offset = Actual value Ax.

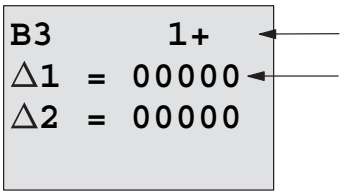
Output Q is set when the signal at input En = 1 and if the actual value at input Ax is out of range of Aen -Δ_2 to Aen + Δ_1 .

Output Q is reset, when the actual value at input Ax lies within the range of Aen -Δ_2 to Aen+ Δ_1, or when the signal at input En changes to lo.

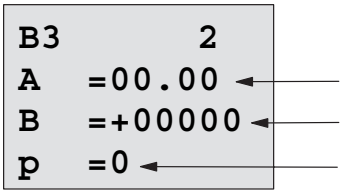
Setting the Par parameter

The gain and offset parameters are used to adapt the used sensors to the respective application.

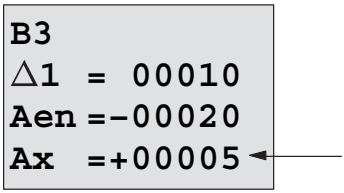
View in programming mode:

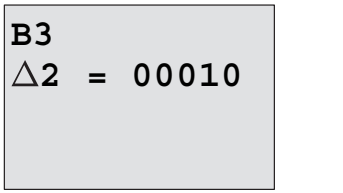


Press ▶



View in parameter assignment mode (example):

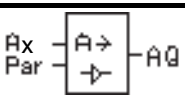




4.4.20 Analog amplifier

Short description

This special function amplifies the value of an analog input and outputs the result at an analog output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Ax	You apply the analog signal to be amplified at input Ax. Use the analog inputs AI1...AI8 (*), the analog memory markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2.
	Parameter	A: Gain Range of values: ±10.00 B: Zero offset Range of values: ±10,000 p: Number of decimals Range of values: 0, 1, 2, 3
	Output AQ	This special function has an analog output! This output can only be connected with the analog input of a function, an analog memory marker or an analog output connector (AQ1, AQ2). Range of values for AQ: -32767...+32767

* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).

Gain and offset parameters

Please note the information on gain and offset parameters in Chapter 4.3.6.

Parameter p (number of decimals)

Applies only to the AQ value in a message text.

Functional description

The function fetches the analog signal of input Ax.

This value is multiplied by the value of the A (gain) parameter, and parameter B (offset) is then added to the product: (Ax•gain) + offset = actual value Ax.

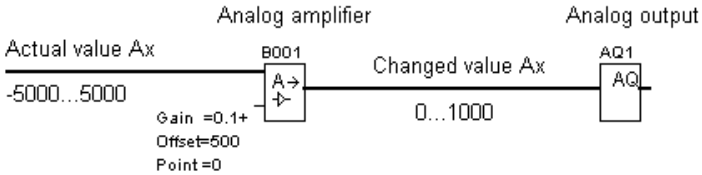
The actual value Ax is output at AQ.

Analog output

Analog output can only process values between 0 and 1000.

Connect an Analog amplifier in front of the analog output to convert the analog output of the special function within a range between 0 and 1000.

The analog output range -5000 to 5000 of a special function is converted to a range between 0 and 1000 in the block diagram below.



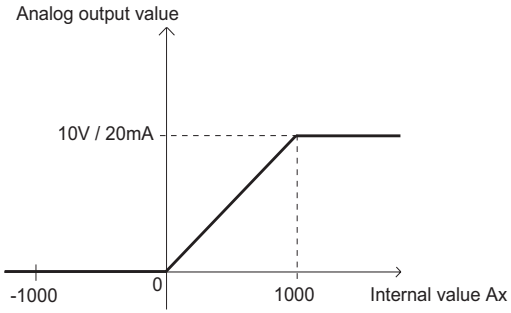
When an analog signal out of the range between 0 to 1000 is inputted to an analog output:

The analog output module operates as below for the analog signal out of the range between 0 to 1000.

- When the type of analog outputs is set to 0-10V/0-20mA:

When internal values less than zero are inputted to the analog output, the analog output module outputs 0V and 0mA.
When internal values more than 1000 are inputted to the analog output, the analog output module outputs 10V and 20mA.

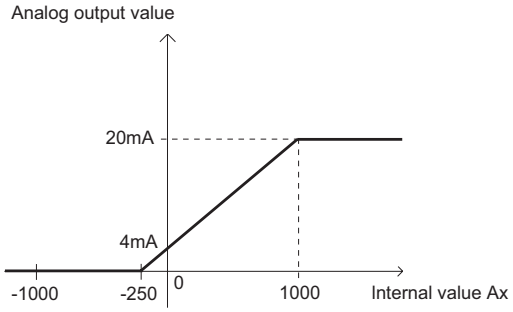
The relationship between the internal value Ax inputted to the analog output and the analog output value:



- When the type of analog outputs is set to 4-20mA:

When internal values less than zero are inputted to the analog output, the analog output module outputs current values less than 4mA.
When internal values more than 1000 are inputted to the analog output, the analog output module outputs 20mA.

The relationship between the internal value Ax inputted to the analog output and the analog output value:

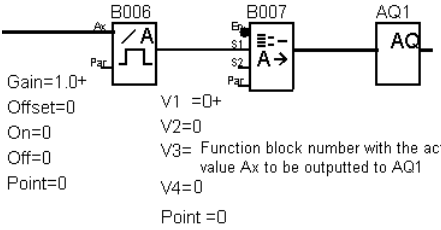


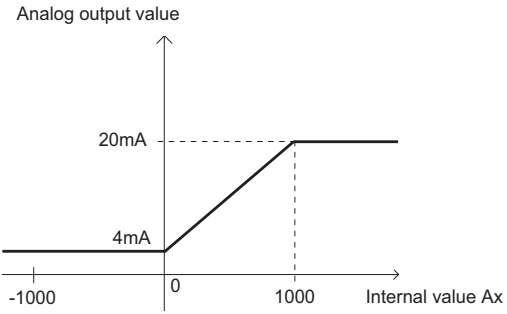
Note

Using an Analog trigger, you can determine that the internal values less than zero or more than 1000 are inputted to the analog output.

When the type of analog outputs is set to 4-20mA, and internal values less than zero are inputted to the analog output, it outputs current values less than 4mA. You may need to prevent the analog output module from outputting current values less than 4mA. To do this, connect the Analog Multiplexer (B007) in front of the analog output (AQ1) and connect the Analog trigger (B006) in front of the Analog Multiplexer to convert the internal values less than zero to internal values equal to or more than zero.

In the block diagram below, the analog output module operates as the lower part of the timing chart.
(example):





Set each parameter of the functions referring to the table below.

	Parameters
Analog trigger (B006 in the above table)	A : Gain = + 1.00 B : Offset = 0 On : On threshold = 0 Off : Off threshold = 0 p : Number of decimals: arbitrary
Analog Multiplexer (B007 in the above table)	V1 = 0 V2 : arbitrary V3 = Function block number with the actual value Ax to be outputted from AQ1 V4 : arbitrary p : Number of decimals: arbitrary

Scaling an analog input value

You can influence the analog input value of a potentiometer by interconnecting an analog input with an analog amplifier and an analog memory marker.

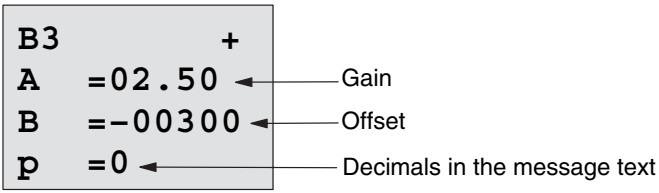
- Scale the analog value at the analog amplifier for further use.
- Connect, for example, the time base for parameter T of a time function (e.g. On-/Off-delay, Chapter 4.4.3) or the on and/or off limit specification of an up/down counter (Chapter 4.4.13) to the scaled analog value.

For more information with programming examples refer to the online help for WindLGC.

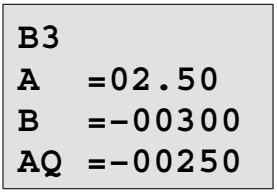
Setting the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

View in programming mode (example):



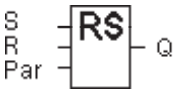
View in parameter assignment mode (example):



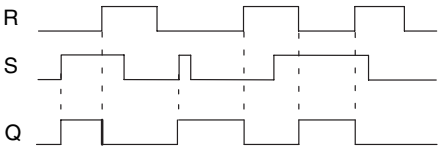
4.4.21 Latching relay

Short description

Input S sets output Q, input R resets output Q again.

Symbol in IDEC SmartRelay	Wiring	Description
	Input S	You set output Q with a signal at input S.
	Input R	You reset output Q with a signal at input R. If S and R = 1, the output is reset.
	Parameter	Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set with a signal at input S, and reset with a signal at input R.

Timing diagram



Switching response

A latching relay represents a simple binary element. The output value depends on the status at the inputs and on the previous output status. The following table shows the logic once again:

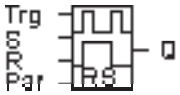
S_n	R_n	Q	Comment
0	0	x	The status is retentive
0	1	0	Reset
1	0	1	Set
1	1	0	Reset (takes priority over Set)

When retentivity is enabled, the current status of the output signal is retained after a power failure.

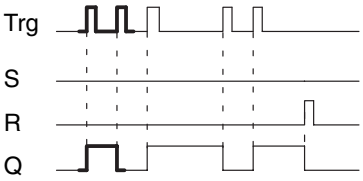
4.4.22 Current impulse relay

Short description

A short pulse at the input sets and resets the output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	You set and reset output Q with a signal at input Trg (Trigger).
	Input S	You set output Q with a signal at input S.
	Input R	You reset output Q with a signal at input R.
	Parameter	Selection: RS (R input priority) or SR (S input priority) Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set with a signal at Trg, and reset with the next signal at Trg, if S and R = 0.

Timing diagram



The bold printed section of the timing diagram is also shown in the symbol for the current impulse relay.

Functional description

Output Q changes its status; that is, the output is set or reset with each 0 to 1 transition at input Trg and if the inputs S and R = 0.

The signal at input Trg does not influence the special function when S or R = 1.

You set the current impulse relay with a signal at input S. The output is set hi.

You reset the current impulse relay with a signal at input R. The output is set lo.

Status diagram

Par	Q_{n-1}	S	R	Trg	Q_n
*	0	0	0	0	0
*	**0**	0	0	0 –> 1	**1****
*	0	0	1	0	0
*	0	0	1	0 –> 1	0
*	0	1	0	0	1
*	0	1	0	0 –> 1	1
RS	0	1	1	0	0
RS	0	1	1	0 – >1	0
SR	0	1	1	0	1
SR	0	1	1	0 –> 1	1
*	1	0	0	0	1
*	**1**	0	0	0 –> 1	**0****
*	1	0	1	0	0
*	1	0	1	0 –> 1	0
*	1	1	0	0	1
*	1	1	0	0 –> 1	1
RS	1	1	1	0	0
RS	1	1	1	0 –> 1	0
SR	1	1	1	0	1
SR	1	1	1	0 –> 1	1

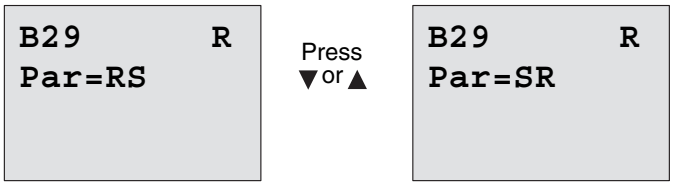
*: RS or SR

**: Triggering signal is effective, because S and R = 0.

Depending on your configuration, either input R takes priority over input S (input S is not effective when R = 1), or vice versa (input R is not effective when S = 1).

After a power failure, the current impulse relay and output Q are reset if you have not enabled retentivity.

View in programming mode:



This special function is not available in parameter assignment mode.

Note

If Trg = 0 and Par = RS, the special function “Current impulse relay ” corresponds with the special function “Latching relay” (see Chapter 4.4.21).

4.4.23 Message texts

Short description

With the message text function block, you can configure a message that includes text and other parameters for IDEC SmartRelay to display in RUN mode.

You can configure simple message texts from the IDEC SmartRelay Display. WindLGC provides an extended set of features for message texts: bar graph representation of data, names for digital I/O states and more. Refer to the WindLGC documentation for information on these features.

Global Message Text Settings

You configure global parameters that apply to all message texts from the Msg Config selections on the Programming menu:

- Analog Time: refresh rate in milliseconds that specifies how frequently analog inputs in message texts are updated
- Tick time: frequency at which message texts scroll on and off the display
  There are two ways that a message text can tick on and off the screen: line by line, or character by character, which are described in more detail below. A line of a text message, or each character of a text message in turn will tick on and off the IDEC SmartRelay Display based on the tick time. For a message that ticks line by line, the actual tick time is ten times the configured tick time. For messages that tick character by character, the actual tick time is the configured tick time.
- CharSets: The primary and secondary character sets from which you can configure message texts. CharSet1 and CharSet2 can be any of the supported character sets for IDEC SmartRelay:

Character Set in IDEC SmartRelay	Common Name	Supports Languages	Internet Reference
ISO8859-1	Latin-1	English, German, Italian, Spanish (partly), Dutch (partly)	http://en.wikipedia.org/wiki/ISO/IEC_8859-1
ISO8859-5	Cyrillic	Russian	http://en.wikipedia.org/wiki/ISO/IEC_8859-5
ISO8859-9	Latin-5	Turkish	http://en.wikipedia.org/wiki/ISO/IEC_8859-9
ISO8859-16	Latin-10	French	http://en.wikipedia.org/wiki/ISO/IEC_8859-16
GB-2312	Chinese	Chinese	http://en.wikipedia.org/wiki/GB2312
Shift-JIS	Japanese	Japanese	http://en.wikipedia.org/wiki/Shift_JIS

- Current Character Set: which character set is selected for the display of message texts

Note

Message texts supported by IDEC SmartRelay FL1D will display on the Text Dispaly only when the following conditions are met:

- CharSet1 is selected and set to ISO8859-1
- Current Character Set "CurrCharSet" is set to CharSet1

Of the fifty possible message texts that you can configure, you can select any number of them to be from the first language and any number from the second language. For example, you could configure fifty message text function blocks that have a single message text for Character Set 1. Alternatively, you could configure twenty-five message text function blocks, each of which has two message texts: one for Character Set 1 and one for Character Set 2. Any combination is valid such that the total does not exceed fifty.

Within a single message text, the text must be from one character set. You can edit message texts in any of the supported character sets from WindLGC. From the IDEC SmartRelay base module, you can only edit text using characters from the ISO8859-1 character set.

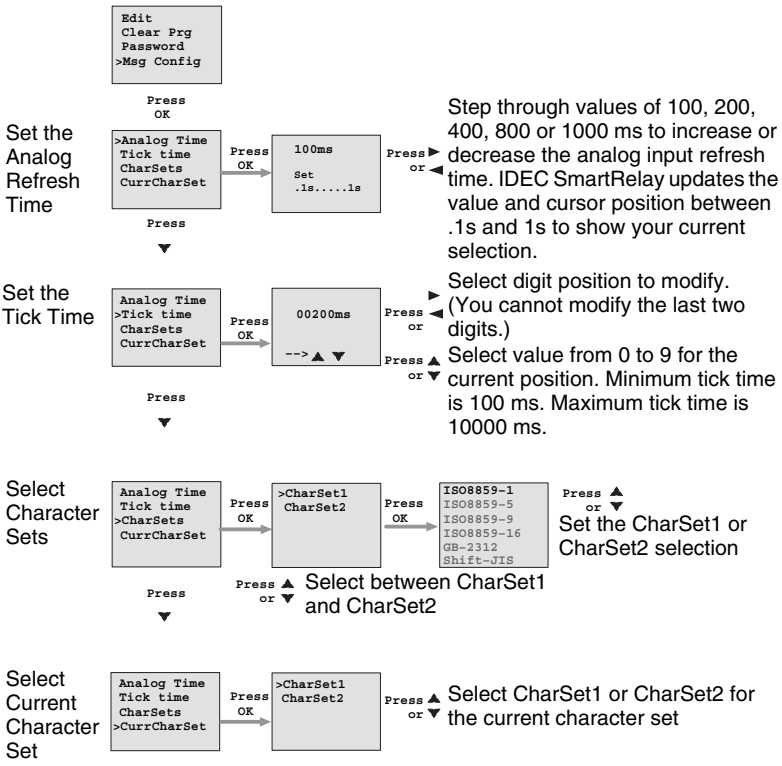
The language and therefore character set of a message text is independent of the language setting for the IDEC SmartRelay display menus. They can be different.

Chinese Character Set

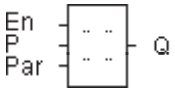
The IDEC SmartRelay base module and Text Display support the Chinese character set (GB-2312) for the People's Republic of China. The devices use Microsoft Windows encoding for this character set. The Windows encoding allows the devices to display the same characters as shown in the WindLGC message text editor when you are using a Chinese emulator or a Chinese version of Microsoft Windows.

The Chinese character set requires a Chinese version of Windows or a Chinese emulator to properly display Chinese characters in the WindLGC message text editor. You must start the Chinese emulator before you open the the message text function block in WindLGC.

Programming Global Message Text Parameters



Message Text Function Block

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A 0 to 1 transition at input En (Enable) starts the output of the message text.
	Input P	P: Priority of the message text Range of values: 0...127 Message destination Message tick settings Ack: Acknowledgment of the message text
	Parameter	Text: Input of the message text Par: Parameter or actual value of another already-programmed function (see ”Visible parameters or process variables”) Time: Display of the continuously updated time-of-day Date: Display of the continuously updated date EnTime: Display of the time of the 0 to 1 transition of the signal at input En EnDate: Display of the date of the 0 to 1 transition of the signal at input En I/O status names: Display of a digital input or output status name, for example “On” or “Off” Analog Input: Display of an analog input value to be shown in message text and updated according to the analog time. **Note:** You can only edit the Text parameter of the message from the IDEC SmartRelay base module. ISO8859-1 is the only available character set for editing text. You can edit all other parameters, and other languages for the Text parameter from WindLGC. See the online help for configuration details.
	Output Q	Q remains set as long as the message text is set.

Restriction

A maximum of 50 message texts are available.

Functional description

When IDEC SmartRelay is in RUN mode, IDEC SmartRelay displays the message text that you have configured along with its parameter values upon a 0 to 1 transition of the signal at input En.

Based on your setting for the message destination, the message text displays on the IDEC SmartRelay Display, the Text Display, or both.

If you use flag M27 in your circuit program, then if M27=0 (low) then IDEC SmartRelay displays the message text only if it is from the primary character set (Character Set 1). If M27=1 (high), then IDEC SmartRelay displays the message text only if is from the secondary character set (Character Set 2). (See the M27 flag description in section 4.1).

If you have configured message ticking, the message will tick on and off the display according to your specifications, either a character at a time, or a line at a time.

If acknowledgment is disabled (Ack = Off), the message text is hidden when the status of the signal at input En changes from 1 to 0.

If acknowledgment is enabled (Ack = On) and the status of the signal at input En changes from 1 to 0, the message text is output until it is acknowledged with **OK**. When En = 1, you cannot acknowledge the message text.

When multiple message text functions are triggered with En=1, IDEC SmartRelay displays the message text with the highest priority (0 = lowest, 127 = highest). This also means that IDEC SmartRelay displays a newly activated message text only if its priority is higher than that of previously activated message texts.

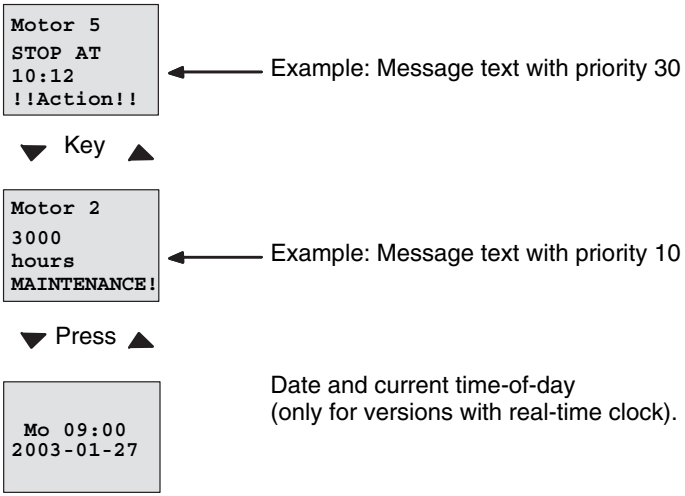
After a message text is disabled or acknowledged, the function automatically shows the previously active message text that takes the highest priority.

You can change the view and the message texts by pressing the keys ▲ and ▼.

Example

This is how two message texts could be shown:

Display field of IDEC SmartRelay in RUN mode



Message Ticking

You can configure message text lines to tick or not tick. Two types of message ticking exist:

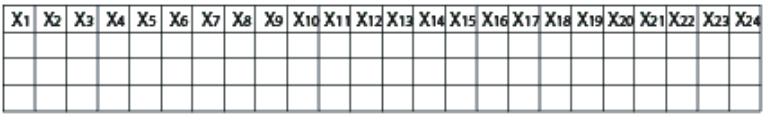
- Character by character
- Line by line

Messages that tick character by character scroll off the characters of the message line one character at a time to the left with the additional characters scrolling in one at a time from the right. The time interval for the tick is specified by the TickTime message text setting.

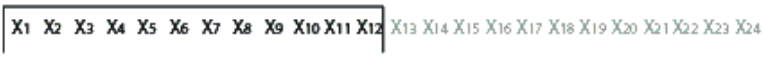
Messages that tick line by line by line scroll one half of the message off the display to the left with the second half of the message scrolling in from the right. The time interval for the tick is ten times the TickTime parameter. The two halves of the message simply alternate on the IDEC SmartRelay Display or Text Display.

Example: Tick Message Character by Character

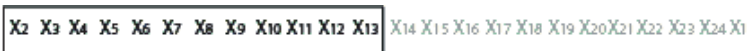
The following illustration shows a one-line, 24-character message text:



If you set this message to tick ”character by character” with a tick interval of 0.1 seconds, then the initial appearance of this message line on the IDEC SmartRelay Display or Text Display is as shown in this illustration:

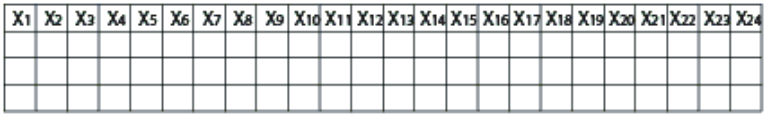


After 0.1 second, one character of the message line ticks. The message appears as follows on the IDEC SmartRelay Display or Text Display:

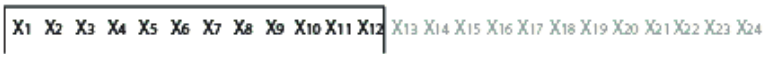


Example: Tick Message Line by Line

The following example uses the same message configuration as the previous example:



If you set this message to tick ”line by line” with a tick interval of 0.1 seconds, then the initial appearance of this message on the IDEC SmartRelay Display or Text Display is the left half of the message as shown in this illustration:



After 1 second (10 x 0.1 second), the message ticks to show the right half of the message as shown in this illustration:

The screen display alternates between the two message halves every second.

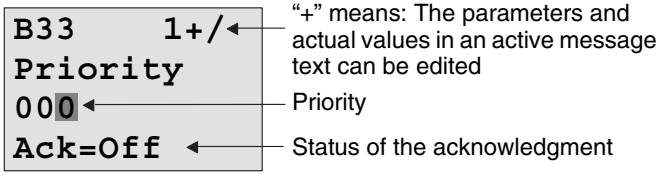
You can configure each individual line of a message text to tick or not tick. The ”character by character” or ”line by line” setting applies to all lines that you configure to tick.

Input P configuration

From the input P, you configure the following characteristics of the message text:

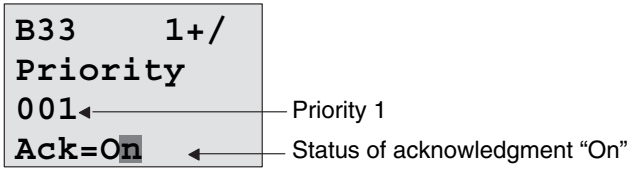
- Priority
- Acknowledgement
- Message destination
- Tick type, and tick setting for each line

To configure the priority and the acknowledgment (programming mode):



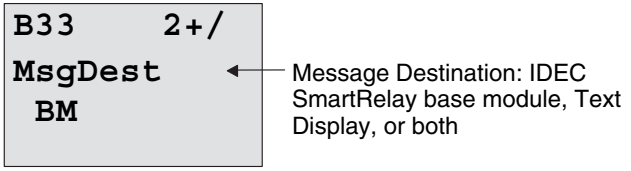
1. Increase the priority to 1: Cursor on '0' +▲
2. Change to 'Ack': Press ▶
3. Enable 'Ack': Press ▲ or ▼

IDEC SmartRelay shows:

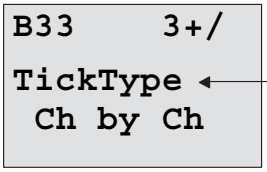


To configure the message destination and tick type (programming mode):

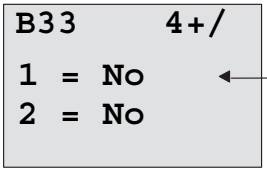
1. From the Priority and Acknowledgement screen form, press ▶ to access the Message Destination screen form.



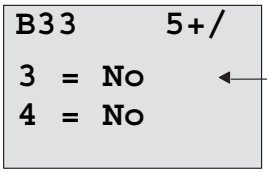
2. Press ▶ to position the cursor on the "BM" line.
3. Press ▲ or ▼ to toggle through the three choices for message destination: BM, TD, or BM & TD.
4. From the Message Destination screen form, press ▶ to access the Tick Type screen form.



5. If your message text has lines that tick, press ▶ to position the cursor on the ”Ch by Ch” line and then press ▲ or ▼ to select either ”Ch by Ch” or ”Ln by Ln” for the TickType.
6. From the Tick T ype screen, press ▶ to enable or disable ticking for each line of the message text. IDEC SmartRelay displays the following screen form:



7. Press ▲ or ▼ to choose between ”No” and ”Yes” to define whether line 1 ticks.
8. Press ▶ to move the cursor to the second line, and press ▲ or ▼ to choose between ”No” and ”Yes” for line 2. From the last line press ▶ to go to the screen from for lines 3 and 4. Configure line ticking for lines 3 and 4 in the same way as for lines 1 and 2.



9. Press **OK** to confirm the complete message text configuration.

Visible parameters or process variables

The following parameters or process variables can be displayed in a message text, as either numerical values or bar-graph representations of values:

Special function	Parameter or process variable visible in a message text
Timers	
On-delay	T, T_a
Off-delay	T, T_a
On-/Off-delay	T_a, T_H, T_L
Retentive on-delay	T, T_a
Interval time-delay relay/ Pulse output	T, T_a
Edge-triggered interval time-delay relay	T_a, T_H, T_L
Asynchronous pulse generator	T_a, T_H, T_L
Random generator	T_H, T_L
Stairwell Light Switch	T_a, T, $T_!$, $T_{!L}$
Dual-function switch	T_a, T, T_L, $T_!$, $T_{!L}$
Seven-day time switch	3*on/off/day
Twelve-month time switch	On, Off
Counter	
Up/down counter	Cnt, On, Off
Operating hours counter	MI, Q, OT
Frequency trigger	f_a, On, Off, G_T
Analog	
Analog trigger	On, Off, A, B, Ax
Analog differential trigger	On, Δ, A, B, Ax, Off
Analog comparator	On, Off, A, B, Ax, Ay, ΔA
Analog value monitoring	Δ, A, B, Ax, Aen
Analog amplifier	A, B, Ax
Analog multiplexer	V1, V2, V3, V4, AQ
Analog ramp control	L1, L2, MaxL, StSp, Rate, A, B, AQ
PI controller	SP, Mq, KC, TI, Min, Max, A, B, PV, AQ
Analog math	V1, V2, V3, V4, AQ
PWM (Pulse Width Modulator)	A, B, T, Ax amplified
Miscellaneous	
Latching relay	-
Current impulse relay	-
Message texts	-
Softkey	On/Off
Shift register	-

For timers, a message text can also display the remaining time. “Remaining time” refers to how much time of the parameter setting remains.

Bar graphs can be either horizontal or vertical representations of the current or actual value scaled between the minimum and maximum value. For more information on configuring and displaying bar graphs in message texts, refer to the WindLGC online help.

Editing message texts

Only simple message texts can be edited from the IDEC SmartRelay base module. Text messages created in WindLGC that make use of new features such as bar graphs, I/O status names, and others can not be edited from the IDEC SmartRelay base module.

Also, you cannot edit message texts from the IDEC SmartRelay base module that contain any of the following parameters:

- Par
- Time
- Date
- EnTime
- EnDate

You can only edit such message texts from WindLGC.

Changing parameters in the active message text

When the message text is active, press **ESC** to select the editing mode.

Note

You must keep the **ESC** key pressed for at least one second

Press ◀ and ▶ to select the relevant parameter. Press **OK** to change the parameter. Use the ▲ and ▼ keys to edit a parameter.

Confirm your changes with **OK**. You can now edit further parameters in the message text (if any exist). Press **ESC** to exit editing mode.

Key input simulation in the active message text

You can enable the four cursor keys C ▲, C ▶ , C ▼ and C ◀ in an active message text by pressing **ESC** plus the relevant cursor key.

Setting the Par parameter

View in programming mode:

Parameter assignment screen form for Par

Press ▶ to select a line for the message text.

Press ▲ and ▼ to select the letter to be displayed in the text. To move the cursor from one position to the other, press ◀ and ▶.

The list of available characters is the same as for the circuit program name. The character set is found in Chapter 3.6.4. When you enter message text from the IDEC SmartRelay base module, you can only enter characters from the ISO8859-1 character set. To enter text from another language, you must enter the text in WindLGC.

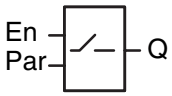
Note that the number of characters per line of message text can be greater than the number of character positions on the IDEC SmartRelay Display.

Press **OK** to confirm your changes, and press **ESC** to exit the editing mode.

4.4.24 Softkey

Short description

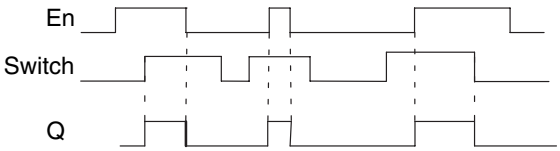
This special function has the effect of a mechanical pushbutton or switch.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	Output Q is set with a 0 to 1 transition of the signal at input En (Enable), and if 'Switch=On' was confirmed in parameter assignment mode.
	Parameter	Programming mode: Selecting the function for pushbutton action for the duration of one cycle, or for switching action. Start: On or off state, initialized at the first start of the program if retentivity is disabled. Retentivity: / = No retentivity R = The status is retentive. Parameter assignment mode (RUN mode): Switch: Switches the momentary pushbutton (switch) on or off.
	Output Q	Switches on if En=1 and Switch=On was confirmed with **OK**.

Factory setting

The default parameter setting is switching action.

Timing diagram



Functional description

In parameter assignment mode, the output is set with a signal at input En, if the ''Switch' parameter is set to 'On' and confirmed with **OK**. Whether the function was configured for pushbutton or switching action is of no concern here.

The output is reset to '0' in the following three cases:

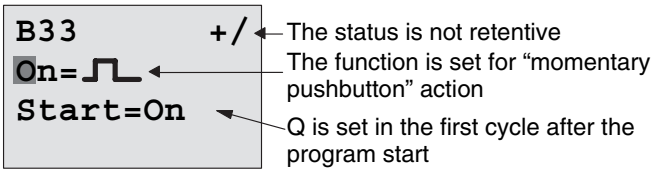
- After a 1 to 0 transition at input En
- When the function was configured for momentary pushbutton action, and one cycle has expired since it was switched on
- When the position 'Off' was selected at the 'Switch' parameter and confirmed with **OK** in parameter assignment mode

If retentivity is not set, output Q is initialized after a power failure according to your configuration at the "Start" parameter.

Setting the Par parameter

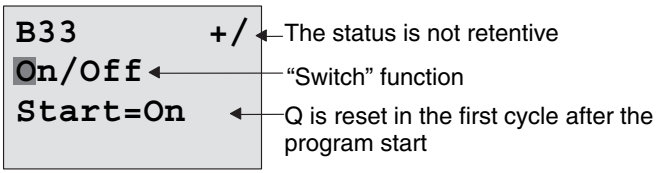
View in programming mode (example):

1. Select the 'Softkey' function.
2. Select input En and confirm with **OK.** The cursor is now positioned below 'Par'.
3. Change to the input mode of 'Par':
   Confirm with **OK**
   (the cursor is now positioned to 'On')

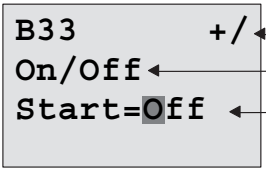

B33 +/
On=
Start=On
The status is not retentive
The function is set for "momentary pushbutton" action
Q is set in the first cycle after the program start

To change 'Par' to 'Switch' action and the initialization status after the program start:

4. To select 'Momentary pushbutton' or 'Switch' action:
   Press ▲ or ▼



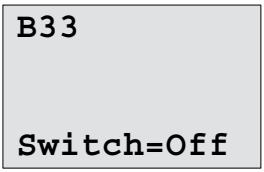
5. To change to the start state:
   Press ◀ or ▶
6. To change the start state:
   Press ▲ or ▼



7. Confirm your entries with
   OK

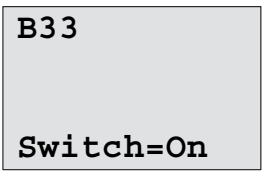
View in parameter assignment mode (example):

Here, you can set or reset the ’Switch’ parameter (On/Off). When in RUN, IDEC SmartRelay shows the following display:



Let us assume you want to set ’Switch’ (On).

1. Change to the editing mode:
   Confirm with **OK**
   (the cursor is now positioned on ’Off’)
2. To change from ’Off’ to ’On’:
   Press ▲ or ▼
3. Confirm your entries with
   Press **OK**

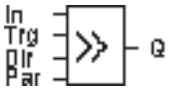


The momentary pushbutton/switch is here switched on

4.4.25 Shift register

Short description

You can use the shift register function to read the value of an input and to shift its bits left or right. The output value corresponds with the configured shift register bit. The shifting direction can be changed at a special input.

Symbol in IDEC SmartRelay	Wiring	Description
	Input In	Input read at the start of the function.
	Input Trg	A positive edge (0 to 1 transition) at input Trg (Trigger) starts the special function. 1 to 0 transitions are irrelevant.
	Input Dir	The signal at input Dir determines the shifting direction for the shift register bits S1...S8: Dir = 0: Shift up (S1 >> S8) Dir = 1: Shift down (S8 >> S1)
	Parameter	Shift register bit that determines the value at output Q. Possible settings: S1 ... S8 Retentivity: / = No retentivity R = The status is retentive.
	Output Q	The output value corresponds with the configured shift register bit.

Functional description

The function reads the value at input In with a positive edge (0 to 1 transition) at input Trg (Trigger).

This value is applied to shift register bit S1 or S8, depending on the shifting direction:

- Shift up: The value at input In is set at S1; the previous value at S1 is shifted to S2; the previous value at S2 is shifted to S3 etc.
- Shift down: The value at input In is set at S8; the previous value at S8 is shifted to S7; the previous value at S7 is shifted to S6 etc.

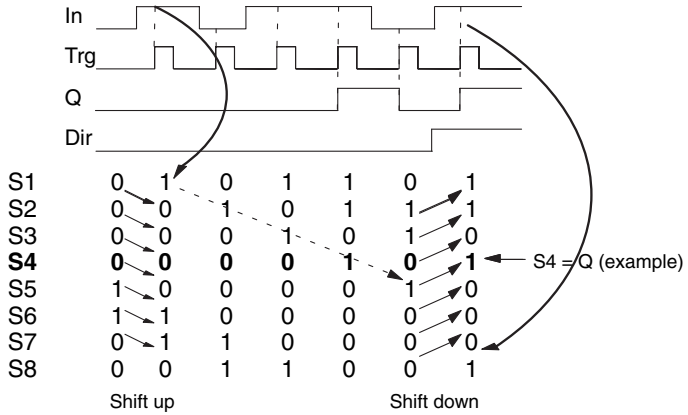
Output Q returns the value of the configured shift register bit.

If retentivity is disabled, the shift function restarts at S1 or S8 after a power failure. When enabled, retentivity always applies to all shift register bits.

Note

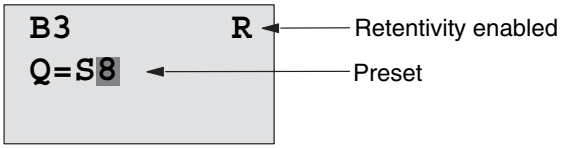
The special function shift register can be used only once in the circuit program.

Timing diagram

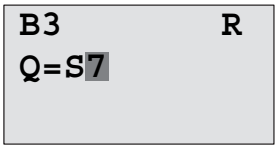


Setting the Par parameter

View in programming mode:



Press ▼



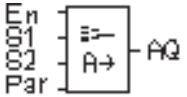
etc. You can select S8...S1.

This special function is not available in parameter assignment mode.

4.4.26 Analog Multiplexer

Short description

This special function outputs one of four predefined analog values or 0 at the analog output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A change in status from 0 to 1 at input En (Enable) switches a parameterized analog value to the output AQ, depending on the value of S1 and S2.
	Inputs S1 and S2	S1 and S2 (selectors) for selecting the analog value to be issued. • S1 = 0 and S2 = 0: Value 1 is issued • S1 = 0 and S2 = 1: Value 2 is issued • S1 = 1 and S2 = 0: Value 3 is issued • S1 = 1 and S2 = 1: Value 4 is issued
	Parameter	V1...V4: Analog values that will be issued. Range of values: -32768...+32767 p: Number of decimals Range of values: 0, 1, 2, 3
	Output AQ	This special function has an analog output. This output can only be connected with the analog input of a function, an analog memory marker or an analog output connector (AQ1, AQ2). Range of values for AQ: -32768...+32767

Parameters V1...V4

The analog values for the parameters V1...V4 can be derived from another already-programmed function. You can use the actual values of the following functions:

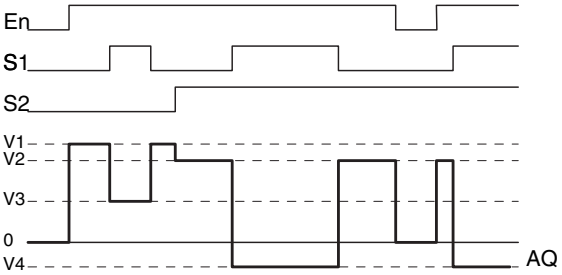
- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. For information on parameter defaults, refer to Chapter 4.4.1.

Parameter p (number of decimals)

Applies only to the values displayed in a message text.

Timing diagram



Functional description

If input En is set, then the function issues one of 4 possible analog values V1 to V4 at the output AQ, depending on the value of S1 and S2.

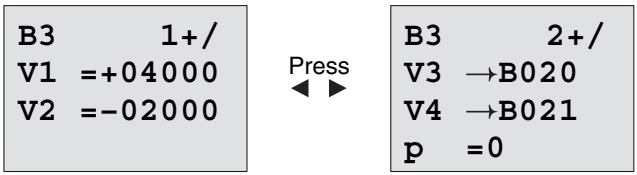
If the input En is not set, then the function issues the analog value 0 at output AQ.

Analog output

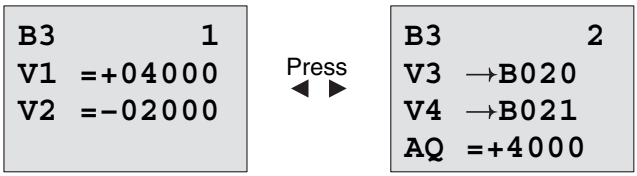
If you interconnect this special function with a real analog output, note that the analog output can only process values between 0 and 1000. To do this, you may need to connect an additional amplifier between the analog output of the special function and the real analog output. Using this amplifier, you standardize the output range of the special function to a value range of 0 to 1000.

Setting the Par parameter

View in programming mode (example):



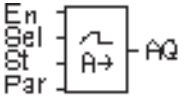
View in parameter assignment mode:



4.4.27 Analog Ramp Control

Short description

The Analog ramp control instruction allows the output to be changed from the current level to the selected level at a specified rate.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A change in the status from 0 to 1 at input En (Enable) applies the start/ stop level (Offset ”B” + StSp) to the output for 100 ms and starts the ramp operation to the selected level. A change in the status from 1 to 0 immediately sets the current level to Offset ”B”, which makes output AQ equal to 0.
	Input Sel	Sel = 0: Level 1 is selected Sel = 1: Level 2 is selected A change in status of Sel causes the current level to start changing to the selected level at the specified rate.
	Input St	A change in the status from 0 to 1 at input St (Decelerated Stop) causes the current level to decrease at a constant rate until the start/stop level (Offset ”B” + StSp) is reached. The start/stop level is maintained for 100ms and then the current level is set to Offset ”B”, which makes output AQ equal to 0.

Symbol in IDEC SmartRelay	Wiring	Description
	Parameter	Level 1 and Level 2: Levels to be reached Range of values for each level: -10,000 to +20,000 MaxL: Maximum value that must not be exceeded under any circumstances. Range of values: -10,000 to +20,000 StSp: Start/Stop offset: value that is added to Offset "B" to create the start/stop level. If the Start/Stop offset is 0, then the start/stop level is Offset "B".. Range of values: 0 to +20,000 Rate: Acceleration with which level 1, level 2 or Offset is reached. Steps/seconds are issued. Range of values: 1 to 10,000 A: Gain Range of values: 0 to 10.00 B: Offset Range of values: ±10,000 p: Number of decimals Range of values: 0, 1, 2, 3
	Output AQ	The output AQ is scaled using the formula: Range of values for AQ: 0 to +32767 (Current Level - Offset "B")/ Gain "A" Range of values: 0 to +32767 Note: When AQ is displayed in parameter mode or message mode, it is displayed as an unscaled value (engineering units: current level).

Parameters L1, L2

The analog values for the parameters L1 and L2 can be derived from another already-programmed function. You can use the actual values of the following functions:

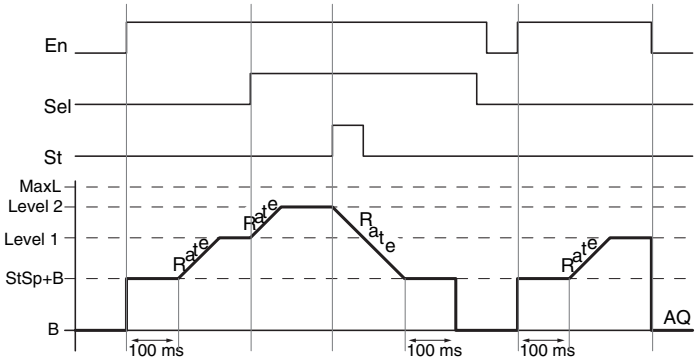
- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. For information on parameter defaults, refer to Chapter 4.4.1.

Parameter p (number of decimals)

Applies only to the AQ, L1, L2, MaxL, StSp and Rate values displayed in a message text.

Timing diagram for AQ



Functional description

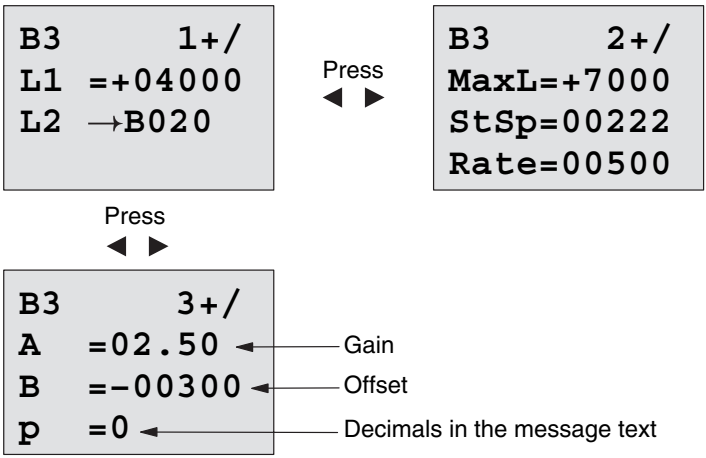
If the input En is set, then the function sets the current level to StSp + Offset ”B” for 100 ms.
Then, depending on the connection of Sel, the function runs from the level StSp + Offset ”B” to either level 1 or level 2 at the acceleration set in Rate.
If the input St is set, the function runs to a level of StSp + Offset ”B” at the acceleration set in Rate. Then the function holds the level at StSp + Offset ”B” for 100 ms. After 100 ms, the level is set to Offset ”B”. The scaled value (output AQ) is 0.
If the input St is set, the function can only be restarted after the inputs St and En have been reset.
If input Sel has been changed, depending on the connection of Sel, the function runs from the current target level to the new target level at the rate that is specified.
If the input En is reset, the function immediately sets the current level to Offset ”B”.
The current level is updated every 100 ms. Note the relationship between output AQ and the current level:
Output AQ = (current level - Offset ”B” / Gain ”A”)

Note

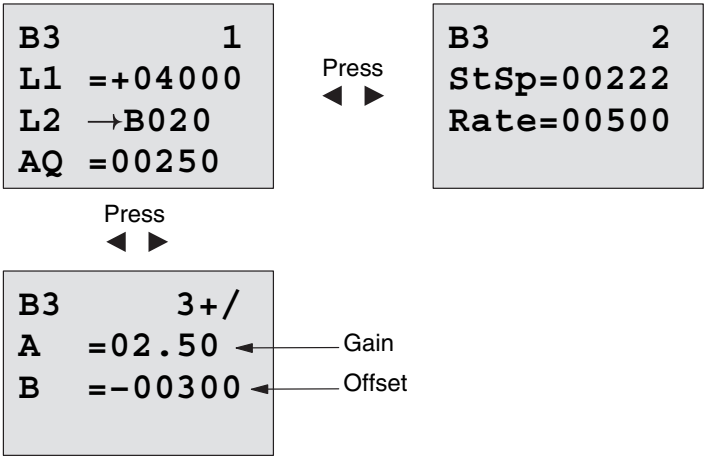
For further information on analog value processing please refer to the online help for WindLGC.

Setting the Par parameter

View in programming mode (example):



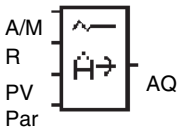
View in parameter assignment mode:



4.4.28 PI controller

Short description

Proportional-action and integral-action controllers. You can use both types of controller individually or combined.

Symbol in IDEC SmartRelay	Wiring	Description
	Input A/M	Set the mode of the controller: 1: automatic mode 0: manual mode
	Input R	Use the input R to reset the output AQ. As long as this input is set, the input A/M is disabled. Output AQ is set to 0.
	Input PV	Analog value: process variable, influences the output

Symbol in IDEC SmartRelay	Wiring	Description
	Parameter	SP: Set-value assignment Range of values: -10,000 to +20,000 KC: Gain Range of values: 00.00 to 99.99 TI: Integral time Range of values: 00:01 to 99:59 m Dir: Action direction of the controller Range of values: + or - Mq: Value from AQ with manual mode Range of values: 0 to 1000 Min: Minimum value for PV Range of values: -10,000 to +20,000 Max: Maximum value for PV Range of values: -10,000 to +20,000 A: Gain Range of values: ±10.00 B: Offset Range of values: ±10,000 p: Number of decimals Range of values: 0, 1, 2, 3
	Output AQ	This special function has an analog output (= manipulated variable). This output can only be connected with the analog input of a function, an analog memory marker or an analog output connector (AQ1, AQ2). Range of values for AQ: 0...1000

Parameters SP and Mq

The set-value SP and the value for Mq can be provided by another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ)
- Up/down counter (actual value Cnt, see Chapter 4.4.13)

Select the required function by the block number. For information on parameter defaults, refer to Chapter 4.4.1.

Parameters KC, TI

Please note:

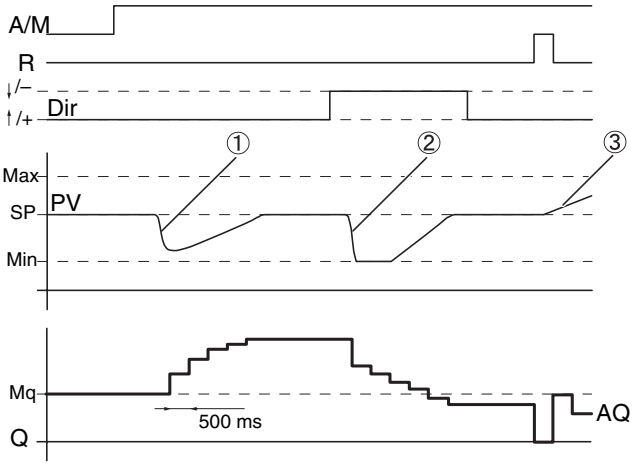
- If parameter KC has value 0, the ”P” function (proportional control) will not be executed.
- If parameter TI has value 99:59 m, the ”I” function (integral-action control) will not be executed.

Parameter p (number of decimals)

Applies only to the PV, SP, Min and Max values displayed in a message text.

Timing diagram

The nature, manner and speed with which the AQ changes depend on the parameters KC and TI. Thus, the course of AQ in the diagram is merely an example. A control action is continuous; therefore the diagram portrays just an extract.



1. A disturbance causes the PV to drop, as Dir is positioned upwards, AQ increases until PV corresponds again to SP.
2. A disturbance causes the PV to drop, as Dir is positioned downwards, AQ decreases until PV corresponds again to SP.
   It is not possible to change the direction (Dir) at runtime of the function. The change is shown here for illustrative purposes only.
3. As AQ is set to 0 by means of the input R, PV changes. This is based on the fact that PV increases, which on account of Dir = upwards causes AQ to drop.

Functional description

If the input A/M is set to 0, then the special function issues output AQ with the value that you set with parameter Mq.

If the input A/M is set to 1, then automatic mode commences. As an integral sum the value Mq is adopted, the controller function begins the calculations.

Note

For further information on the controller basics please refer to the online help for WindLGC.

The updated value PV is used to calculate in the formulas:

Updated value PV = (PV•gain) + offset

- If the updated value PV = SP, then the special function does not change the value of AQ.
- Dir = upwards (+) (timing diagram numbers 1. and 3.)
  - If the updated value PV > SP, then the special function reduces the value of AQ.
  - If the updated value PV < SP, then the special function increases the value of AQ.
- Dir = downwards (-) (timing diagram number 2.)
  - If the updated value PV > SP, then the special function increases the value of AQ.
  - If the updated value PV < SP, then the special function reduces the value of AQ.

With a disturbance, AQ continues to increase / decrease until the updated value PV again corresponds to SP. The speed with which AQ changes depends on the parameters KC and TI.

If the input PV exceeds the parameter Max, then the updated value PV is set to the value of Max. If the PV falls short of the parameter Min, then the updated value PV is set to the value of Min.

If the input R is set to 1, then the AQ output is reset. As long as R is set, the input A/M is disabled.

Sampling time

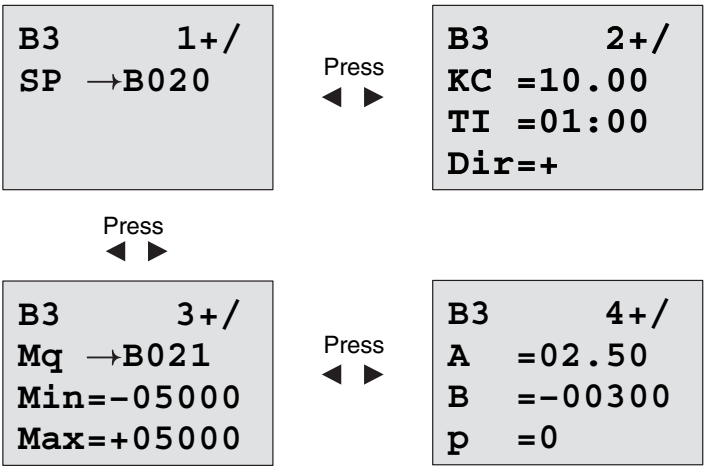
The sampling time is fixed at 500 ms.

Parameter sets

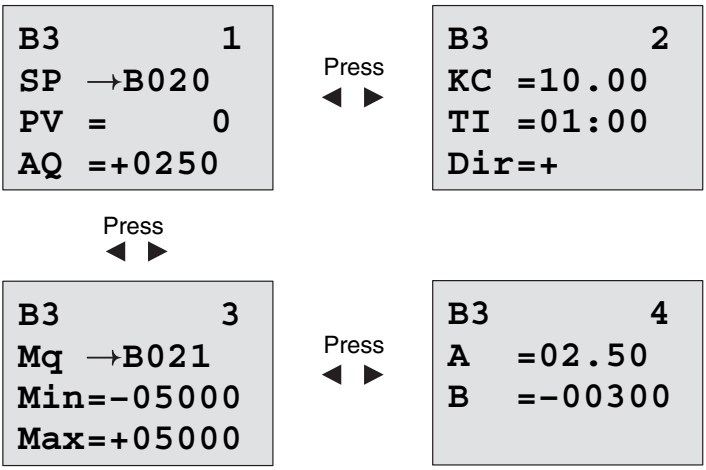
For more information and application examples with application-related parameter sets for KC, TI and Dir refer to the online help for WindLGC.

Setting the Par parameter

View in programming mode (example):



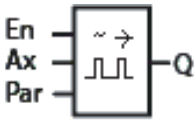
View in parameter assignment mode:



4.4.29 Pulse Width Modulator (PWM)

Short description

The Pulse Width Modulator (PWM) instruction modulates the analog input value Ax to a pulsed digital output signal. The pulse width is proportional to the analog value Ax.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Ax	Analog signal to be modulated to a pulsed digital output signal.
	Parameter	Min: Range of values: ±20,000 Max: Range of values: ±20,000 A: Gain Range of values: ±10.00 B: Zero offset Range of values: ±10,000 T: Periodic time over which the digital output is modulated p: Number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set or reset for the proportion of each time period according to the proportion of the standardized value Ax to the analog value range.

Parameter T

Note the defaults of the T parameters listed in Chapter 4.3.2.

The periodic time T can be provided by the actual value of another already-programmed function. You can use the actual value of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Parameters p (number of decimals)

Parameter p applies only to the display of the Ax value in a message text

Functional description

The function reads the value of the signal at the analog input Ax.
This value is multiplied by the value of parameter A (gain). Parameter B (offset) is added to the product, as follows:

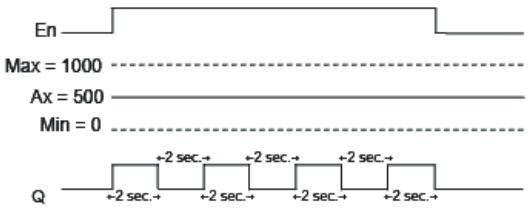
(Ax * Gain) + Offset = Actual value Ax

The function block calculates the proportion of the actual value Ax to the range. The block sets the digital output Q high for the same proportion of the T (periodic time) parameter, and sets Q low for the remainder of the time period.

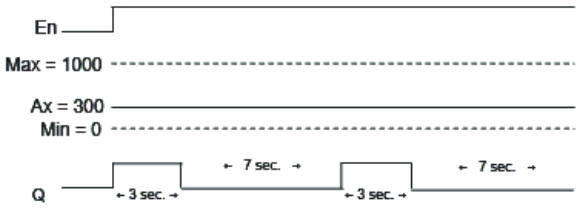
Examples with Timing Diagrams

The following examples show how the PWM instruction modulates a digital output signal from the analog input value:

1. An analog value of 500 (range 0...1000) as the value for Ax must be modulated to a digital signal string. The user-defined T (periodic time) parameter is 4 seconds. At the digital output of the PWM function the digital signal string is 2 seconds high, 2 seconds low, 2 seconds high, 2 seconds low and continues in that pattern as long as parameter En = high.



2. An analog value of 300 (range 0...1000) as the value for Ax must be modulated to a digital signal string. The user-defined T (periodic time) parameter is 10 seconds. At the digital output of the PWM function the digital signal string is 3 seconds high, 7 seconds low, 3 seconds high, 7 seconds low and continues in that pattern as long as parameter ”En” = high.



Calculation rule

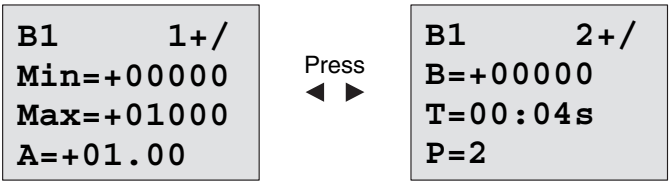
Q = 1, for (Ax - Min)/ (Max - Min) of time period T, when Min < Ax < Max
Q = 0, for PT - [(Ax - Min) / (Max - Min)] of time period T.

Note

Ax in this calculation refers to the actual value Ax as calculated using the Gain and Offset.

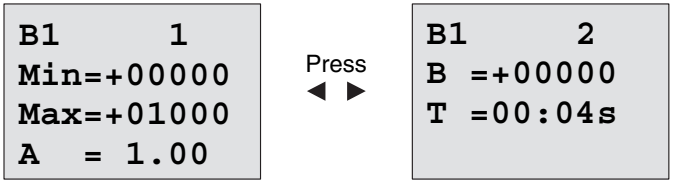
Setting the Par Parameter

The following illustration shows the view in programming mode that corresponds to the first example:



Use the ◄ and ► keys to navigate to the Min, Max, A, B, T and P parameters. For each digit of a value, use the ▲ and ▼ keys to scroll through value choices. Use the ► key to navigate to the second screen from the last line of the first screen, and the ◄ key to navigate from the top line of the second screen to the first screen. Use the OK key to accept changes.

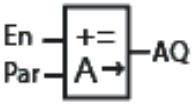
View in parameter assignment mode:



4.4.30 Analog math

Short description

The analog math block calculates the value AQ of an equation formed from the user-defined operands and operators.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A change in the status from 0 to 1 at input En (Enable) enables the analog math function block.
	Parameter	**V1:** First operand value **V2:** Second operand value **V3:** Third operand value **V4:** Fourth operand value **Op1:** First operator **Op2:** Second operator **Op3:** Third operator **Pr1:** Priority of first operation **Pr2:** Priority of second operation **Pr3:** Priority of third operation **Qen→0:** 0: Reset value of AQ to 0 when En=0 1: Retain last value of AQ when En=0 **p:** Number of decimals Range of values: 0, 1, 2, 3
	Output AQ	The output AQ is the result of the equation formed from the operand values and operators. AQ will be set to 32767 if a divide by 0 or overflow occurs, and -32768 if a negative overflow (underflow) occurs.

Parameters V1...V4

The analog values for the parameters V1...V4 can be derived from another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ)
- Analog ramp control (actual value AQ, see Chapter 4.4.27)
- Analog math (actual value AQ, see Chapter 4.4.30)
- PI controller (actual value AQ, see Chapter 4.4.28)
- Up/down counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by the block number. For information on parameter defaults, refer to Chapter 4.4.1.

Note

If the analog value for parameter V1, V2, V3 or V4 is derived from another already-programmed function whose actual value exceeds the value range for V1 ... V4, IDEC SmartRelay will display the limit value: -32768 if the value is less than the lower range or 32767 if the value is greater than the upper range).

Parameters p (number of decimals)

Parameter p applies only to the display of Value1, Value2, Value3, Value4 and AQ in a message text.

Functional Description

The analog math function combines the four operands and three operators to form an equation. The operator can be any one of the four standard operators: +, -, *, or /. For each operator, you must set a unique priority of High (H), Medium(M), or Low(L). The high operation will be performed first, followed by the medium operation, and then by the low operation. You must have exactly one operation of each priority. The operand values can reference another previously-defined function to provide the value. The analog math function rounds the result to the nearest integer value.

The number of operand values is fixed at four and the number of operators is fixed at 3. If you need to use fewer operands, use constructions such as + 0 or * 1 to fill the remaining parameters.

You can also configure the behavior of the function when the Enable parameter En=0. The function block can either retain its last value, or be set to 0. If the parameter Qen→0 = 0, then the function sets AQ to 0 when En=0. If the parameter Qen→0 = 1, then the function leaves AQ at its last value when En=0.

Possible errors: Zero division and overflow

If the analog math function block execution results in zero division or overflow, it sets internal bits that indicate the type of error that occurred. You can program an analog math error detection function block in your circuit program to detect these errors, and to control the program behavior as needed. You program one analog math error detection function block to reference one specific analog math function block.

Examples

The following tables show some simple example analog math block parameters, and the resulting equations and output values:

V1	Op1(Pr1)	V2	Op2(Pr2)	V3	Op3(Pr3)	V4
12	+ (M)	6	/ (H)	3	- (L)	1

Equation: (12 + (6 / 3)) - 1
Result: 13

V1	Op1(Pr1)	V2	Op2(Pr2)	V3	Op3(Pr3)	V4
2	+ (L)	3	* (M)	1	+ (H)	4

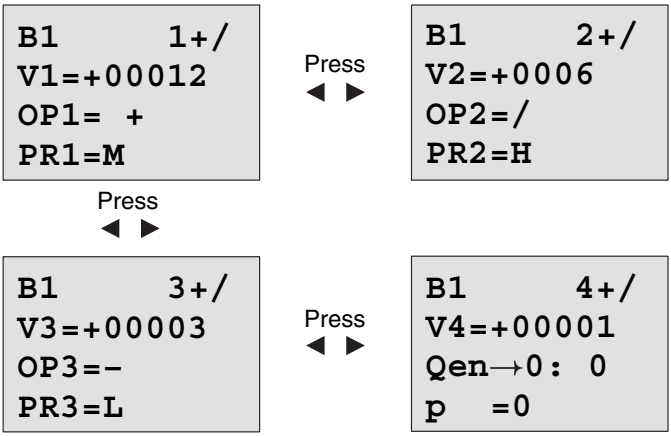
Equation: 2 + (3 * (1 + 4))
Result: 17

V1	Op1(Pr1)	V2	Op2(Pr2)	V3	Op3(Pr3)	V4
100	- (H)	25	/ (L)	2	+ (M)	1

Equation: (100 - 25) / (2 + 1)
Result: 25

Setting the Par parameter

The following illustration shows the view in programming mode that corresponds to the first example (12 + (6 / 3)) - 1:

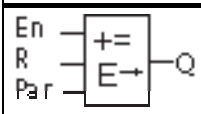


Use the ◄ and ► keys to navigate between the operand value, operator, and operation priority. To change a value, use the ▲ and ▼ keys to scroll through value choices for each value. Use the ◄ key to navigate from one screen to the previous screen when the cursor is on the V1..V4 line, and the ► key to navigate to the next screen from the PR1..PR3 line. Use the OK key to accept changes.

4.4.31 Analog math error detection

Short description

The analog math error detection block sets an output if an error has occurred in the referenced analog math function block.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A change in the status from 0 to 1 at input En (Enable) enables the analog math error detection block.
	Input R	A signal at input R resets the output.
	Parameter	MathBN: block number of an analog math instruction Err: ZD: Divide by 0 error OF: Overflow error ZD/OF: (Divide by 0 error) OR (Overflow error) AutoRst: Reset the output before the next execution of the analog math error function block. Y = yes; N = no
	Output Q	Q is set high if the error to detect occurred in the last execution referenced analog math function block

Parameter MathBN

The value for the MathBN parameter references be the block number of an already-programmed analog math function block.

Functional description

The analog math error detection block sets the output when the referenced analog math function block has an error. You can program the function to set the output on a zero division error, an overflow error, or when either type of error occurs. If AutoRst is set, the output is reset prior to the next execution of the function block. If AutoRst is not set, then whenever the output is set it remains set until the analog math error detection block is reset with the R parameter. This way, even if the error subsequently clears, the circuit program still has knowledge that an error did occur at some point.

In any scan cycle, if the referenced analog math function block executes before the analog math error detection function block, the error is detected in the same scan cycle. if the referenced analog math function block executes after the analog math error detection function block, the error is detected in the next scan cycle

Analog math error detection logic table

In the table below, Err represents the parameter of the analog math error detection instruction that selects which type of error to detect. ZD represents the zero division bit set by the analog math instruction at the end of its execution: 1 if the error occurred, 0 if not. OF represents the overflow bit set by the analog math instruction: 1 if the error occurred, 0 if not. The ZD/OF Err parameter represents the logical OR of the zero division bit and overflow bit of the referenced analog math instruction. Q represents the output of the analog math error detection function. An ”x” indicates that the bit can be either 0 or 1 with no influence on the output.

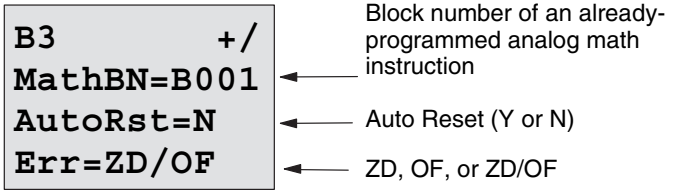
Err	ZD	OF	Q
ZD	1	x	1
ZD	0	x	0
OF	x	1	1
OF	x	0	0
ZD/OF	1	0	1
ZD/OF	0	1	1
ZD/OF	1	1	1
ZD/OF	0	0	0

If the MathBN parameter is null, then the output Q is always 0.

Setting the Par parameter

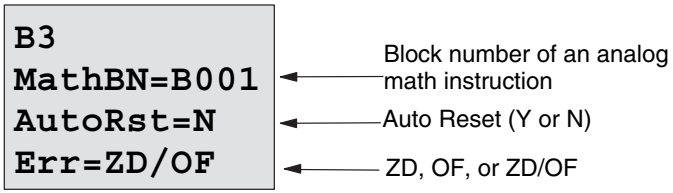
The parameters MathBN, AutoRst, and Err can be set in programming mode or parameter assignment mode.

View in programming mode (example):



Use the ◀ and ▶ keys to navigate between the MathBN, AutoRst, and Err parameters. To change a value, use the ▲ and ▼ keys to scroll through value choices for each value. Use the OK key to accept changes.

View in parameter assignment mode (example):



Configuring IDEC SmartRelay 5

Parameter assignment refers to the configuration of the block parameters. You can set delay times for time functions, the switching times of timers, counter threshold values, the monitoring interval of an operating hours counter, the on and off thresholds of the trigger, and more.

You can configure the parameters

- In programming mode
- In parameter assignment mode

In programming mode, the author of the circuit program also sets the parameters

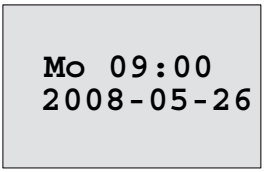
Parameter assignment mode allows the editing of parameters without having to modify the circuit program. This feature is available so that you can edit parameters without having to change to programming mode. The advantage: The circuit program remains protected, but can be adapted by the user to meet specific requirements.

Note

In parameter assignment mode, IDEC SmartRelay continues execution of the circuit program.

5.1 Selecting parameter assignment mode

Press **ESC** to change from RUN to parameter assignment mode:



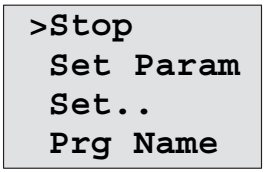
...Press ESC

Note

The following applies to earlier device versions up to FL1A:

- You open parameter assignment mode by pressing **ESC**+**OK**.

IDEC SmartRelay changes to parameter assignment mode and opens the parameter assignment menu:

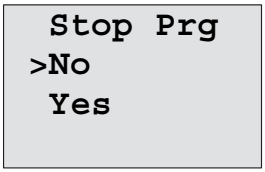


Description of the four menu items of the parameter assignment menu

- **Stop**

You select this command to stop your circuit program and thus change to the main menu of programming mode. To do so:

1. To move the '>' cursor to '**Stop**': Press ▲ or ▼
2. To confirm 'Stop': Press **OK**



3. To move the '>' cursor to '**Yes**': Press ▲ or ▼
4. To confirm 'Yes': Press **OK**

IDEC SmartRelay shows the main menu of the programming mode:

```
>Program..
 Card..
 Setup..
 Start
```

- **Set Param**

For information on the various parameters, refer to the Chapters 5.1.1 to 5.1.3.

- **Set..**

For information on the various settings, refer to Chapter 5.2.

- **Prg Name**

This menu command only allows you to **read** the name of your circuit program. It is not possible to modify this name in parameter assignment mode (see Chapter 3.6.4).

5.1.1 Parameters

Note

In the following discourse on parameters, we presume that the respective default parameter protection mode (“+”) has been maintained. This is a prerequisite for viewing and editing parameters in the parameter assignment mode! See Chapter 4.3.5 and the example on Page 90.

Parameters are, for example:

- The delay times of a timer relay.
- The switching times (cams) of a timer switch.
- Counter thresholds
- The monitoring time for hour counters
- The trigger thresholds.

Each one of the parameters is identified by its block number (Bx) and the shortname of the parameter. Examples:

- T:...is a configurable time.
- MI:...is a configurable time interval.

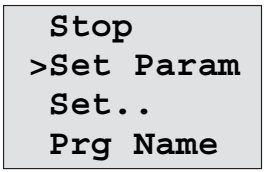
Note

WindLGC also allows you to assign names to blocks (for more information, refer to Chapter 7).

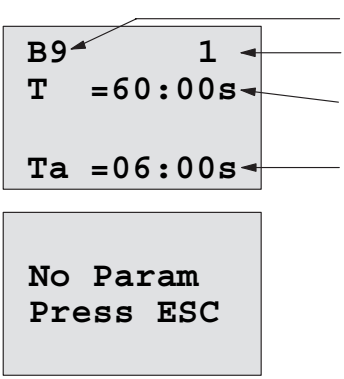
5.1.2 Selecting the parameters

To select a parameter:

1. On the parameter assignment menu, select '**Set Param**': Press ▼ or ▲



2. Confirm with **OK**.
   IDEC SmartRelay shows the first parameter. If no parameter can be set, you can press ESC to return to the parameter assignment menu.


B9 1
T =60:00s
Ta =06:00s
Block number
Display number for functions with several displays
The value set at parameter T (Time)
The current time in IDEC SmartRelay

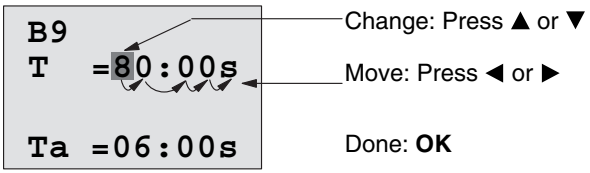
3. Now, select the desired parameter: Press or ▲ or ▼.
4. Select the parameter you want to edit, and press **OK**.

5.1.3 Modifying parameters

You first select the parameter you want to edit (see Chapter 5.1.2).

You change the value of the parameter in the same way as you did in programming mode:

1. Move the cursor to the point at which you want to make the change: Press ◀ or ▶
2. To change this value: Press ▲ or ▼
3. To apply the value: **OK**



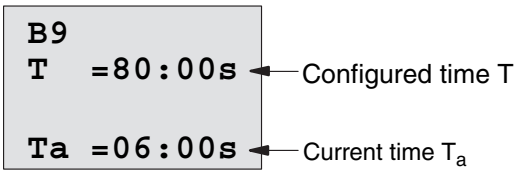
Note

When changing the time parameters when the system is in RUN, you can also change the timebase (s = seconds, m = minutes, h = hours). This does not apply if the time parameter represents the result of another function (for an example, see Chapter 4.4.1). In this case you can neither change the value nor the timebase.

The current time is reset to zero when you change the timebase.

Current value of a time T

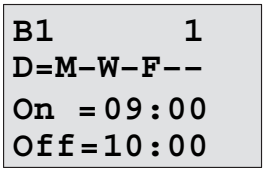
View of a time T in parameter assignment mode:



You can change the configured time T.

Current timer value

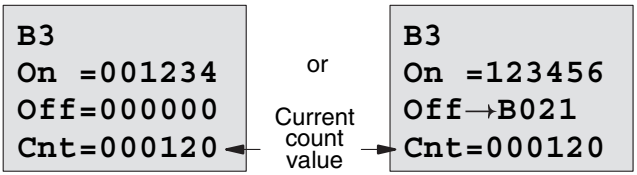
View of a timer cam in parameter assignment mode:



You can change the on/off times and the day.

Current value of a counter

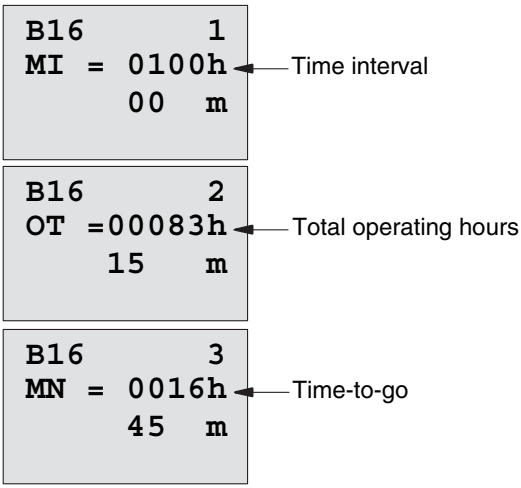
View of a counter parameter in parameter assignment mode:



You can change the on/off threshold. This does not apply if the on or off threshold represents the result of another function (in the example in section 4.4.13, this is B021).

Current value of an hour counter

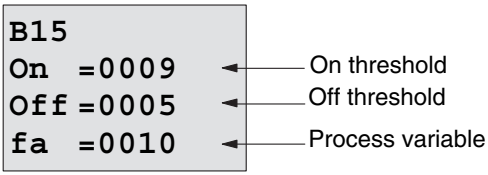
View of an hour counter parameter in parameter assignment mode:



You can edit the configured time interval MI.

Current value of a frequency trigger

View of the parameter of a frequency trigger in parameter assignment mode:



You can change the on/off threshold.

5.2 Setting the default values for IDEC SmartRelay

You can set the following default values for an IDEC SmartRelay base module:

Clock settings

You can set the default values for time-of-day and date, summertime/wintertime conversion and synchronization:

- in parameter assignment mode by means of the set menu (“Clock” menu item)
- in programming mode by means of the setup menu (“Clock” menu item).

Time-of-day and date see Chapter 5.2.1.

Summertime/wintertime conversion see Chapter 3.6.14.

Synchronization see Chapter 3.6.15.

Contrast and backlight settings

You can set the default values for the display contrast and backlight:

- in parameter assignment mode by means of the set menu (“LCD” menu item)
- in programming mode by means of the setup menu (“LCD” menu item).

See Chapter 5.2.2.

Menu Language

You can set the language in which the IDEC SmartRelay menus will be displayed:

- in parameter assignment mode by means of the set menu (“Menu Lang” menu item)
- in programming mode by means of the setup menu (“Menu Lang” menu item)

Number of base module Analog Inputs

The IDEC SmartRelay base modules FL1E-H12SND, and FL1E-H12RCE/FL1E-B12RCE support four analog inputs. Formerly they supported two. You can choose whether to use two or four analog inputs on these modules:

- in parameter assignment mode by means of the set menu (“BM AI NUM” menu item)
- in programming mode by means of the setup menu (“BM AI NUM” menu item)

Start screen settings

You can select the default setting for the start screen that displays on IDEC SmartRelay and the Text Display when IDEC SmartRelay transitions to RUN mode:

- in parameter assignment mode by means of the set menu (“StartScreen” menu item)

See Chapter 5.2.5.

Message Text settings

You can select settings that apply to all message text function blocks from the Programming menu. See Chapter 4.4.23.

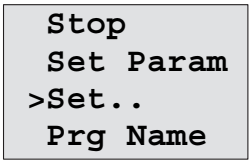
5.2.1 Setting the time of day and date (FL1E-H12RC...)

You can set the time of day and the date

- in parameter assignment mode by means of the set menu (“Clock” menu item)
- in programming mode by means of the setup menu (“Clock” menu item)

To set the TOD and the date in parameter assignment mode:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select ’**Set..**’: Press ▲ or ▼

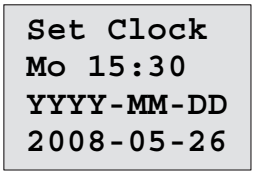


3. Confirm ’Set..’: Press **OK**
4. Move the ’>’ cursor to ’**Clock**’: Press ▲ or ▼
5. Confirm ’Clock’: Press **OK**
6. Move the ’>’ cursor to ’**Set Clock**’: Press ▲ or ▼
7. Apply ’Set Clock’: Press **OK**

Note

The ‘Set Clock’ command is only executed if your IDEC SmartRelay is equipped with a real-time clock (FL1E-H12RC...). You set the real-time clock of IDEC SmartRelay by means of the ‘Set Clock’ command.

IDEC SmartRelay shows the following display.



The cursor is positioned on the weekday.

8. Select the day of the week: Press ▲ or ▼
9. Move the cursor to the next position: Press ◀ or ▶
10. To change the value: Press ▲ or ▼
11. To set the correct TOD, repeat steps 9. and 10.
12. To set the correct date, repeat steps 9. and 10.
13. To confirm your entries: Press **OK**

To set the TOD and the date in programming mode:

If you want to set the TOD and the date in programming mode, select '**Setup**' in the main menu, then menus '**Clock**' and '**Set Clock**'. You can now set the weekday and the time as described earlier (as of step 8.).

5.2.2 Setting the display contrast and backlight choice

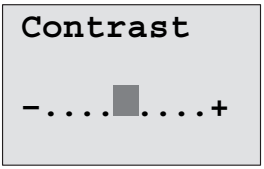
You can set the default value for the display contrast

- in parameter assignment mode by means of the set menu ("LCD" menu item)
- in programming mode by means of the setup menu ("LCD" menu item).

To set the display contrast in parameter assignment mode:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select '**Set**': Press ▼ or ▲
3. Confirm 'Set..': Press **OK**
4. On the Set menu, select 'LCD': Pres ▼ or ▲
5. Confirm 'LCD..': Press **OK**
6. By default, the cursor points to **Contrast**. If not, move the '>' cursor to '**Contrast**': Press ▲ or ▼
7. Confirm 'Contrast': Press **OK**

IDEC SmartRelay shows the following display:



8. To change the display contrast: Press ◀ or ▶
9. To confirm your entry: Press **OK**

To set the display contrast in programming mode:

If you want to set the display contrast in programming mode, select '**Setup**' in the main menu, then menu '**Contrast**'. You can now set the display contrast as described earlier (as of step 8.).

To set the back light choice in parameter assignment mode:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select '**Set**': Press ▼ or ▲
3. Confirm 'Set..': Press **OK**
4. On the Set menu, select 'LCD': Press ▼ or ▲
5. Confirm 'LCD..': Press **OK**
6. Move the '>' cursor to '**BackLight**': Press ▲ or ▼
7. Confirm '**BackLight**': Press **OK**
8. Move the '>' cursor to '**Default**' or '**AlwaysOn**': Press ▲ or ▼

The default is that the back light is not on. To set the back light to always be on, select the '**AlwaysOn**' choice.

To set the back light choice in programming mode:

If you want to set the backlight choice in programming mode, select '**Setup**' in the main menu, then menu 'LCD'. You can now set the back light choice as described earlier (as of step 6.).

Note

The backlight lifetime of the Text Display is 20,000 hours.

5.2.3 Setting the menu language

The language of the IDEC SmartRelay menus can be one of ten predefined languages:

CN (Chinese)	DE (German)	EN (English)	ES (Spanish)	FR (French)
IT (Italian)	NL (Dutch)	RU (Russian)	TR (Turkish)	JP(Japanese)

To set the menu language in parameter assignment mode:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select '**Set**': Press ▼ or ▲
3. Confirm 'Set..': Press **OK**
4. On the Set menu, select '**Menu Lang**': Press ▼ or ▲
5. Confirm 'Menu Lang': Press **OK**
6. Move the '>' cursor to the language of your choice: Press ▲ or ▼
7. Confirm language selection. Press **OK**

To set the menu language in programming mode:

If you want to set the menu language in programming mode, select '**Setup**' in the main menu, then menu '**Menu Lang**'. You can now set the menu language as described earlier (as of step 6.).

To reset IDEC SmartRelay to its default language setting:

If you want to restore IDEC SmartRelay to its default language setting (English), do the following:

1. Switch off IDEC SmartRelay and then switch it on again.
2. When an hour glass icon displays, press ◄, ► and OK together until the English menu entries appear.

5.2.4 Setting the number of AIs in the base module

FL1E-H12RCE/FL1E-B12RCE and FL1E-H12SND support up to four onboard inputs that can be used as either digital or analog inuts (0 ...10V). Inputs I7 (AI1) and I8 (AI2) are available as analog inputs by default, whether you use them or not. Inputs I1 (AI3) and I2 (AI4) are optional analog inputs. IDEC SmartRelay provides a menu where you can choose to use two analog inputs (the default, AI1 and AI2), or four. Regardless of the settings, inputs I1 and I2 can be used as digital inputs. To use them as analog inputs AI3 and AI4, you must set the 'BM AI NUM' to four. Note that the number of configured analog inputs on the base module affects the subsequent numbering of analog inputs on attached expansion modules (See the "Maximum setup (Page 20)" topic).

To set the number of AIs in parameter assignment mode:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select '**Set**': Press ▼ or ▲
3. Confirm 'Set..': Press **OK**
4. On the Set menu, select '**BM AI NUM**': Press ▼ or ▲
5. Confirm 'BM AI NUM': Press **OK**
6. Move to '2AI' or '4AI': Press ▲ or ▼
7. Confirm selection. Press **OK**

To set the number of AIs in programming mode:

If you want to set the number of AIs in programming mode, select '**Setup**' in the main menu, then menu '**BM AI NUM**'. You can now set the number of AIs as described earlier (as of step 6.).

Note

If you change the number of analog inputs, IDEC SmartRelay re-starts automatically.

5.2.5 Setting the start screen

You can select the default setting for the start screen that IDEC SmartRelay and the Text Display will display in RUN mode. You make this selection from the parameter assignment mode by means of the set menu (“StartScreen” menu item).

To select the start screen:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select ’**Set..**’: Press ▼ or ▲
3. Confirm ’Set..’: Press **OK**
4. Move to ’**StartScreen**’: Press ▲ or ▼
5. Confirm ’StartScreen’: Press **OK**

IDEC SmartRelay shows the following display:

```
>Clock
 Input DI
StartScreen
 Clock
```

The current setting of the start screen is shown in the bottom row. The default setting is ’Clock’.

You can choose between the display of the current time-of-day and date, or the values of the digital inputs:

6. Select the desired default setting: Press ▲ or ▼
7. To confirm your entry: Press **OK**

IDEC SmartRelay displays your selection.

Power the IDEC SmartRelay base module off then on to make your changes take effect. When IDEC SmartRelay is in RUN mode, both IDEC SmartRelay and the Text Display will display the start screen that you selected.

6 IDEC SmartRelay memory and battery cartridge (card)

IDEC SmartRelay provides the following cartridges for program storage and real-time clock backup:

- IDEC SmartRelay Memory cartridge
- IDEC SmartRelay Battery cartridge
- IDEC SmartRelay Memory/Battery cartridge

Each of the three cartridges is color-coded to make them easily distinguishable from one another. They also vary in size. The IDEC SmartRelay Memory cartridge (purple) provides storage for the circuit program. The IDEC SmartRelay Battery cartridge (green) provides battery backup of the real-time clock for up to two years. The IDEC SmartRelay Memory/Battery cartridge (dark brown) provides both circuit program storage and battery backup of the real-time clock.

Warning

Risk of death, personal injury or property damage can occur if you use the battery cartridge or combined memory/battery cartridge in a hazardous location.

Use the battery cartridge or combined memory/battery cartridge only in non-hazardous locations.

The FL1E IDEC SmartRelay Memory cartridge and the FL1E IDEC SmartRelay Memory/Battery cartridge provide 32 Kbytes memory space: four times the memory space of the FL1D IDEC SmartRelay Memory cartridge.

IDEC SmartRelay allows you to store only one circuit program in its memory. If you want to modify the circuit program or create an additional one without deleting the first, you must archive it somewhere.

You can copy the IDEC SmartRelay circuit program to an IDEC SmartRelay Memory cartridge or IDEC SmartRelay Memory/Battery cartridge. You can then insert this cartridge in another IDEC SmartRelay in order to copy the circuit program. This enables you to manage your programs in the following ways:

- Archive circuit programs
- Reproduce circuit programs

- Send circuit programs by mail
- Write and test your circuit program at the office, and then transfer it to an IDEC SmartRelay in the switching cabinet

IDEC SmartRelay is supplied with a hood. The IDEC SmartRelay Memory cartridge, IDEC SmartRelay Battery cartridge and IDEC SmartRelay Memory/Battery cartridge are supplied separately.

Note

You do **not** need a memory cartridge or combined memory/battery cartridge to backup the circuit program in your IDEC SmartRelay.

The IDEC SmartRelay circuit program is automatically stored in nonvolatile memory when you exit the programming mode.

The memory cartridge or combined memory/battery cartridge can backup all data in the IDEC SmartRelay circuit program memory. The order numbers are found in the appendix.

Compatibility (Old memory cartridges in newer IDEC SmartRelay modules)

... to earlier versions (FL1C and FL1D devices):

Data written to the memory cartridge in the FL1D can be read in all FL1E. But data written to the memory cartridge in the FL1C cannot be read by the FL1E. When the memory cartridge is read by the FL1E, the original data in the FL1E is deleted. Data cannot be written from the FL1E to the memory cartridge.

... to earlier versions (FL1A to FL1B devices):

A memory cartridge that contains data written in earlier versions (FL1A...FL1B devices) cannot be used in IDEC SmartRelay devices of the FL1C and later generations. When the IDEC SmartRelay system detects such an 'old' memory cartridge, the message "Unknown Card / Press ESC" is output to the display.

Vice versa, a FL1C or later memory cartridge cannot be used in IDEC SmartRelay devices of the FL1A...FL1B family.

Compatibility (New memory, battery, or combined memory/ battery cartridges in older IDEC SmartRelay modules)

The FL1E memory cartridge can be used in FL1C or FL1D devices but cannot be used in FL1A..FL1B devices. Data written to the FL1E memory cartridge in the FL1C cannot be read by the FL1E. When the memory cartridge is read by the FL1E, the original data in the FL1E is deleted.

A FL1E Memory cartridge or FL1E Memory/Battery cartridge that already has FL1E circuit program stored on it cannot be used in any device other than FL1E device.

A FL1E Battery cartridge or FL1E Memory/Battery cartridge can only be used in FL1E devices.

Upward compatibility of circuit programs

Circuit programs written for the previous versions FL1A...FL1D can be transferred to FL1E units from WindLGC.

For detail about the compatibility of SmartRelay and memory cartridges, refer to FAQ available on IDEC website. (URL: http://www.idec.com/faq/en/controller/).

6.1 Security function (CopyProtect)

The secuirty function provides copy protection for circuit programs on memory cartridges or combined memory/ battery cartridges.

Unprotected memory cartridges

You can edit circuit programs without restrictions and exchange data between the memory cartridge or combined memory/battery cartridge and the device.

Protected memory cartridges

A circuit program is **protected** when it is transferred from a protected program memory cartridge or combined memory/ battery cartridge to IDEC SmartRelay.

To execute this circuit program in IDEC SmartRelay, the protected cartridge must remain inserted during RUN; that is, the circuit program stored on the cartridge cannot be copied to other IDEC SmartRelay devices.

Over and above that, a protected circuit program is write-protected.

A circuit program **with password** protection is no longer protected after the correct password has been entered; that is, you can then edit the program and remove the memory cartridge or combined memory/battery cartridge.

Note

When you create the circuit program for a memory cartridge or combined memory/battery cartridge, you need to assign a password to be able to edit it at a later time (see Chapter 3.6.5).

Correlation between the password and the protective function

Password	Protection	Editing	Copying	Deleting
-	-	Yes	Yes	Yes
Yes	-	Yes, with password	Yes	Yes, with password
-	Yes	No	No	Yes
Yes	Yes	Yes, with password	Yes, with password	Yes, with password

Assigning a security function

To assign a circuit program and copy protection function to the memory cartridge or combined memory/battery cartridge, open the programming mode and select “Card”.

1. Switch IDEC SmartRelay to programming mode (ESC / >Stop).
2. Select the ’**Card**’ command: Press ▲ or ▼
3. To apply ’Card’: Press **OK**
4. Move the ’>’ cursor to ’**CopyProtect**’: Press ▲ or ▼
5. To apply ’CopyProtect’: Press **OK**

IDEC SmartRelay shows the following display:

```
>No
 Yes
CopyProtect:
 No
```

The current protection setting is shown in the bottom line. This function is disabled by default (”No“: disabled).

Enabling the security function

To set the security function:

1. Move the ’>’ cursor to ’**Yes**’: Press ▲ or ▼
2. Confirm ’Yes’: Press **OK**

IDEC SmartRelay shows the following display:

```
>No
 Yes
CopyProtect:
 Yes
```

Note

This only generates a circuit program and copy protection for the memory cartridge or combined memory/battery cartridge; the circuit program itself must be copied separately from IDEC SmartRelay to the memory cartridge or combined memory/battery cartridge. (This copy can be done at power-on. See chapter 6.4).

You can always change the “No” status (security function disabled) to “Yes” (security function enabled).

A status change from “Yes” (security function enabled) to “No” (security function disabled) is only possible if the memory cartridge or combined memory/battery cartridge does not contain a circuit program.

6.2 Inserting and removing memory and battery cartridges

When you remove a memory cartridge or combined memory/battery cartridge that contains a circuit program with copy protection attributes, note the following: The circuit program stored on the cartridge can only be executed if the cartridge remains inserted during system runtime.

After you have removed the memory cartridge or combined memory/battery cartridge, IDEC SmartRelay outputs the message 'No Program'. A removal of the cartridge during RUN will lead to impermissible operating states.

Always heed the following warning:

Warning

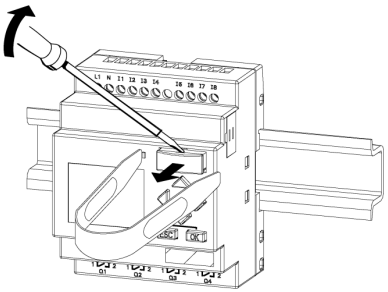
Do not touch the open slot of the memory cartridge with your fingers or with a metallic or conductive object.

The memory cartridge socket might be under voltage if the polarity is accidentally reversed at L1 and N.

The memory cartridge, battery cartridge or combined memory/battery cartridge must only be removed by qualified personnel.

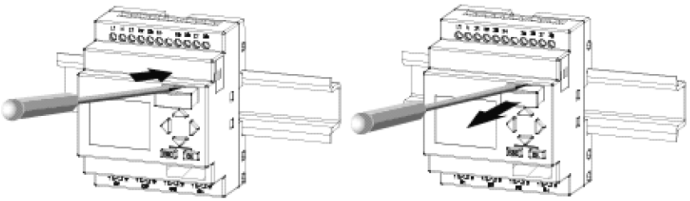
Removing the memory cartridge, battery cartridge or combined memory/battery cartridge

To remove the memory cartridge, carefully insert a screwdriver with a 3-mm blade into the groove on the upper end of the card, and lever the module partially out of the slot. You can now remove the memory cartridge.



1. Carefully insert a screwdriver into the slot at the upper end of the memory cartridge, and ease it out of the slot a little.
2. Hold the memory cartridge at both sides using the memory cartridge removal tool (MT-101). and pull the memory cartridge straight out.

To remove a battery cartridge, or combined memory/battery cartridge, slide a screwdriver with a 3-mm blade into the slot on the upper surface of the card until it engages in the back, then with the screwdriver engaged, pull the card out with your hand.



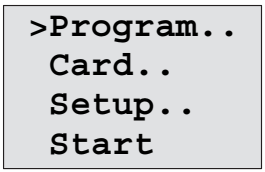
Inserting a memory cartridge, battery cartridge or combined memory/battery cartridge

The entry of the memory cartridge, battery cartridge and the combined memory/battery cartridge slot is chamfered on its bottom right. The edge of the cartridges are chamfered accordingly. This encoding prevents you from inserting cartridges the wrong way. Insert the memory cartridge, battery cartridge or combined memory/battery cartridge into the slot and push it in until it engages.

6.3 Copying data from IDEC SmartRelay to the memory cartridge

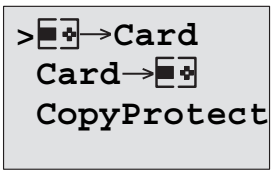
To copy the circuit program to the memory cartridge or combined memory/battery cartridge:

1. Insert the memory cartridge or combined memory/battery cartridge into the slot.
2. Switch IDEC SmartRelay to programming mode (ESC / >Stop).



IDEC SmartRelay main menu

3. The main menu opens. To select the '**Card**' command: Press ▲ or ▼
4. Press **OK**. The transfer menu opens.

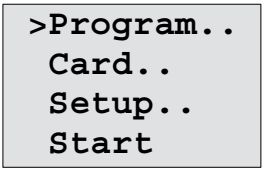


= IDEC SmartRelay

5. Move the '>' cursor to '**IDEC SmartRelay** → **Card**' (if required): Press ▲ or ▼
6. Press **OK**.

IDEC SmartRelay now copies the circuit program to the memory cartridge or combined memory/battery cartridge. (If the memory cartridge is from an incompatible FL1A..FL1C version, IDEC SmartRelay displays this message: "Unknown Card / Press ESC" .)

When IDEC SmartRelay has finished copying, it automatically returns you to the main menu:



The circuit program backup is now stored on your memory cartridge or combined memory/battery cartridge and you can remove the cartridge. **Do not forget** to replace the cap.

If power fails while IDEC SmartRelay is copying the circuit program, repeat the process after Power On.

Note

The password of a protected circuit program in IDEC SmartRelay also applies to the copied program version on your memory cartridge or combined memory/battery cartridge.

6.4 Copying data from the memory cartridge to IDEC SmartRelay

You can copy a circuit program from a compatible memory cartridge or combined memory/battery cartridge to IDEC SmartRelay in one of two ways:

- Automatically during the startup of IDEC SmartRelay (POWER ON)
- By means of the “Card” menu of IDEC SmartRelay

Note

If the program on the module/cartridge is protected with a password, the copied program in IDEC SmartRelay is also protected with the same password.

Automatic copying during the startup of IDEC SmartRelay

Proceed as follows:

1. Switch off the power supply to IDEC SmartRelay (POWER OFF)
2. Remove the slot cover.
3. Insert the program module/cartridge into the relevant slot.
4. Switch on the power supply to IDEC SmartRelay

IDEC SmartRelay copies the program from the program module/cartridge to IDEC SmartRelay. (If the memory cartridge is from an incompatible FL1A..FL1B version, IDEC SmartRelay displays this message: “Unknown Card / Press ESC” .)

When IDEC SmartRelay has finished copying, it opens the main menu:

```
>Program..
 Card..
 Setup..
 Start
```

Note

Before you switch IDEC SmartRelay to RUN, you must ensure that the system you are controlling with IDEC SmartRelay does not represent a source of hazard.

1. Move the '>' cursor to '**Start**': Press ▲ or ▼
2. Press **OK**.

Copying by means of the "Card"menu

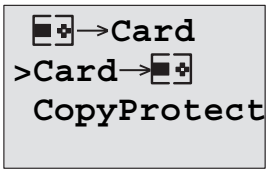
For information on the replacement of a memory cartridge or combined memory/battery cartridge, also note Chapter 6.2. To copy a program from the memory cartridge or combined memory/battery cartridge to IDEC SmartRelay:

1. Insert the memory cartridge or combined memory/battery cartridge
2. Switch IDEC SmartRelay to programming mode (ESC / >Stop).

```
>Program..
 Card..
 Setup..
 Start
```

3. Move the '>' cursor to '**Card**': Press ▲ or ▼
4. Press **OK**. The transfer menu opens.

5. Move the '>' cursor to '**Card** → **IDEC SmartRelay**': Press ▲ or ▼



= IDEC SmartRelay

6. Press **OK**.

IDEC SmartRelay copies the circuit program from the memory cartridge or combined memory/battery cartridge to IDEC SmartRelay. (If the memory cartridge is from an incompatible FL1A..FL1B version, IDEC SmartRelay displays this message: "Unknown Card / Press ESC".)

When IDEC SmartRelay has finished copying, it automatically returns to the main menu.

IDEC SmartRelay software 7

WindLGC is available as a programming package for the PC. This software provides many features, for example:

- A graphic interface for offline creation of your circuit program by means of Ladder Diagram (contact chart / circuit diagram) or Function Block Diagram (function chart)
- Simulation of your circuit program on the PC
- Generating and printing of an overview chart for the circuit program
- Saving a backup of the circuit program on the hard drive or other media
- Comparing circuit programs
- Easy configuration of blocks
- Transferring the circuit program in both directions:
  - from IDEC SmartRelay to the PC
  - from the PC to IDEC SmartRelay
- Reading the values of the hour counter
- Setting the time of day
- Summertime/wintertime conversion
- Online test: Display of status changes and process variables of IDEC SmartRelay in RUN mode:
  - Status of a digital I/O, memory markers, shift register bits and cursor keys
  - The values of all analog I/Os and memory markers
  - The results of all blocks
  - The current values (including the times) of selected blocks
- Starting and stopping circuit program execution via the PC (RUN, STOP)

The IDEC SmartRelay alternatives

As you can see, WindLGC represents an alternative to conventional engineering methods, with several advantages:

- You can develop the circuit program on your PC.
- You simulate the circuit program on your computer and verify its functions before you actually implement it in your system.
- You can add comments to the circuit program and create hardcopies.
- You can save a copy of your circuit program to the file system on your PC, to make it directly available for modifications.
- It takes only a few key actions to download the circuit program to IDEC SmartRelay.

WindLGC

WindLGC runs under Windows Vista®, Windows 98®, Windows NT 4.0®, Windows Me®, Windows 2000®, Windows XP®. WindLGC is capable of client/server operation and offers you a high degree of freedom and comfort for creating your circuit program.

WindLGC V6.0

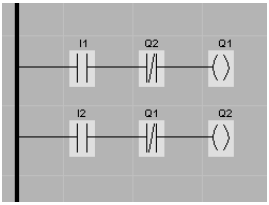
This is the current version of WindLGC. You will find all the functions and the functionality of the devices described in this manual in the version 6.0.

Note

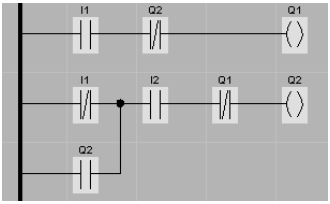
Please note that the SmartRelay ladder programming is slightly different from PLC programming.In the case of a PLC, the output result on each line is reflected on the inputs within the same scan time. However, in the case of the IDEC SmartRelay, all the inputs are processed first and then the outputs. Thus the output results are not reflected on the inputs within the same scan time, but rather they are reflected at the following scan.

ex) Interlock is not activated in the sample program (1) below in which input terminals I1 and I2 are simultaneously turned on. The interlock is activated in the sample program (2) below in which input terminals I1 and I2 are simultaneously turned on.

(1)



(2)



7.1 Connecting IDEC SmartRelay to a PC

Connecting the PC cable

To connect IDEC SmartRelay to a PC, you need the IDEC SmartRelay PC cable (Appendix E lists the order number).

Turn the power off to the IDEC SmartRelay base module. Remove the cap, memory cartridge, or combined memory/ battery cartridge from your IDEC SmartRelay and connect the cable to this socket. Connect the other end of the cable to the serial port of your PC.

Connecting the USB PC cable

You can also connect IDEC SmartRelay to the PC with the IDEC SmartRelay USB PC cable (Appendix E lists the order number).

Remove the cap or memory cartridge, battery cartridge, or combined memory/battery cartridge from your IDEC SmartRelay and connect the cable to this socket. Connect the other end of the cable to a USB port of your PC.

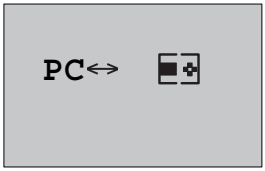
Switching IDEC SmartRelay to PC↔IDEC SmartRelay mode

Switch the IDEC SmartRelay with/without display to STOP from your PC (refer to the WindLGC online help), or select the ESC / >Stop command on a device with display and confirm the entry with 'Yes'.

When IDEC SmartRelay is in STOP and online with the PC, the following PC commands are accepted:

- Switch IDEC SmartRelay to RUN
- Read/write the circuit program
- Read/write the summertime/wintertime

When you start the upload/download in STOP, the following display appears automatically:



= IDEC SmartRelay

Closing the PC↔IDEC SmartRelay mode

When the data transfer is completed, the connection to the PC is shut down automatically.

Note

If the circuit program created with WindLGC is password protected, both the circuit program and the password are downloaded to IDEC SmartRelay. The password prompt is enabled at the end of the data transfer.

The upload of a password protected program created in IDEC SmartRelay is only possible after the correct password is entered in WindLGC.

Applications

8

We have provided a small collection of applications in this manual to give you an impression of the versatility of IDEC SmartRelay. For these examples we have recorded once again the original solution of the circuit diagram, and compared it with the IDEC SmartRelay solutions.

You can find solutions for the following tasks:	Page
Stairway or corridor lighting system	page 265
Automatic door	page 269
Ventilation system	page 276
Factory gate	page 281
Central controlling and monitoring of several factory gates	page 285
Luminous rows	page 289
Service water pump	page 293

Note

IDEC SmartRelay applications are available to all our customers free of charge. The examples provided are noncommittal, serve as general information about the fields of application for IDEC SmartRelay, and may be different to user-specific solutions.

The user operates the system at his own responsibility. We refer to the relevant national standards and system-related installation regulations.

Although you have four inputs available for logic operations (basic functions, see Chapter 4.2), the following figures will only show a maximum of three inputs for reasons of clarity. You program this fourth input and assign parameters just like the other three inputs.

Errors can not be ruled out, and the right to make changes is reserved.

8.1 Stairway or corridor lighting

8.1.1 Requirements for a stairway lighting system

The basic requirements for a stairway lighting system are as follows:

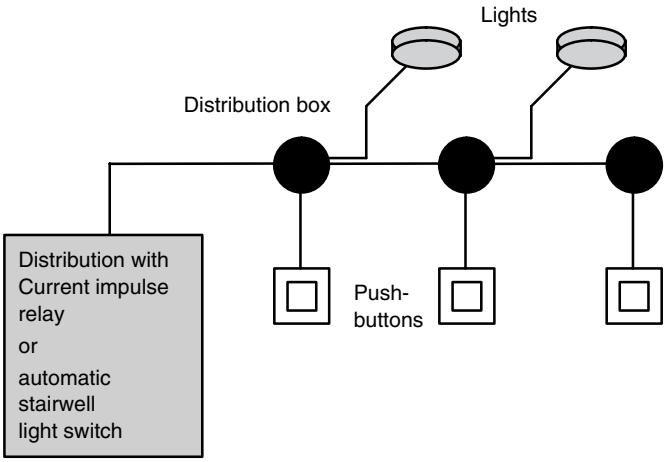
- When someone is using the stairway, the lighting should be switched on.
- If no-one is in the stairway, the lights should be switched off in order to save energy.

8.1.2 Previous solution

The two conventional options for switching the lights:

- With a current impulse relay
- With an automatic stairwell light switch

The wiring of both these lighting systems is identical.



Components used

- Momentary switches
- Automatic stairwell light switch or current impulse relay

Lighting system with current impulse relay

Function of a lighting system with current impulse relay :

- Press any pushbutton: The lighting is switched on
- Press any of the pushbuttons once again: The lighting is switched off.

Disadvantage: People often forget to switch off the lights.

Lighting system with an automatic stairwell light switch

Function of a lighting system with automatic stairwell light switch:

- Press any pushbutton: The lighting is switched on
- The lights are switched off automatically when the preset time has expired.

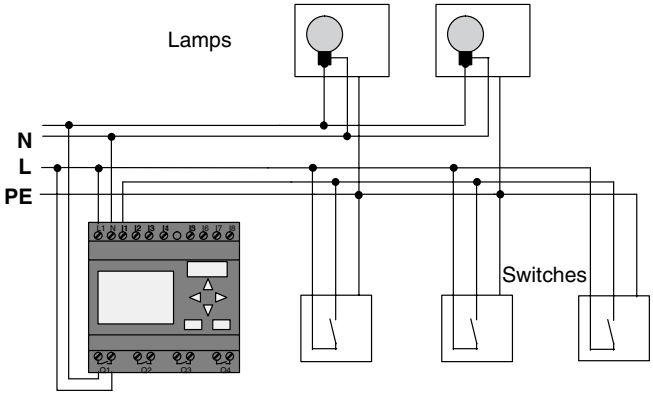
Disadvantage: The lights can not be switched on for a longer period of time (e.g. when cleaning the stairway). The switch for permanent lighting is usually located on the automatic stairwell light switch and may be difficult or impossible to access.

8.1.3 Lighting system with IDEC SmartRelay

An IDEC SmartRelay system allows you to replace the automatic stairwell light switch or the current impulse relay. You can also implement both functions (timed off-delay and Current impulse relay) in a single unit. What is more, you can incorporate extra functions without making any alterations to the wiring. Here are some examples:

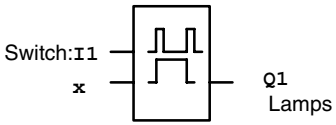
- Current impulse relay with IDEC SmartRelay
- Automatic stairwell light switch with IDEC SmartRelay
- Dual-function switch with IDEC SmartRelay
  - Switch light on
  - Switch on permanent lighting
  - Switch light off

Wiring of a lighting system with FL1E-H12RCC



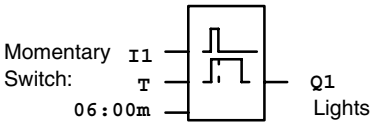
The external wiring of a lighting system with an IDEC SmartRelay is no different than it is for a conventional stairway and corridor lighting system. Only the automatic stairwell light switch/current impulse relay is replaced. Supplementary functions are entered directly in IDEC SmartRelay.

Current impulse relay with IDEC SmartRelay



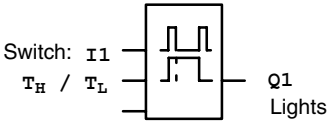
Output Q1 is toggled with a pulse signal at input I1.

Automatic stairwell light switch with IDEC SmartRelay



Output Q1 is set for the duration of 6 minutes with a pulse signal at input I1.

Dual-function switch with IDEC SmartRelay



Output Q1 is set for the duration of a preset time T_H with a pulse signal at input I1.
The permanent lighting function is enabled by keeping the momentary switch pressed for a specified time T_L.

8.1.4 Special features and expansion options

Other options for increasing comfort or saving energy are, for example:

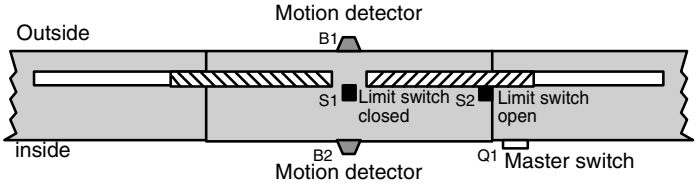
- A flashing function that indicates that the light is about to be switched off automatically.
- You can integrate various central functions:
  - Central off
  - Central on (panic button)
  - Control of all lamps or individual circuits by means of a daylight control switch
  - Controlling by means of an integrated timer (e.g. permanent lighting only until 24.00 h; disabled at specific times)
  - Automatically switching off the permanent lighting on expiration of a preset time (e.g. after 3 hours)

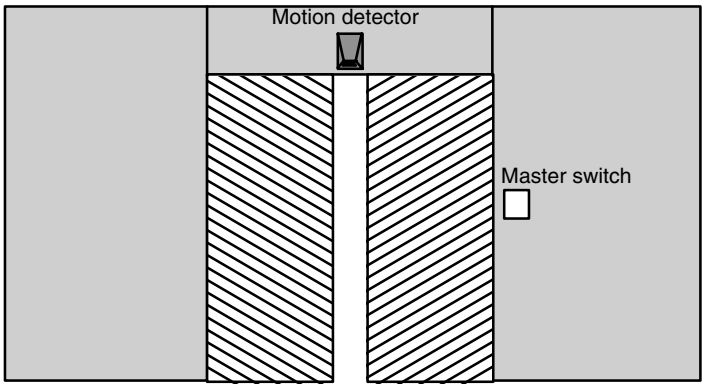
8.2 Automatic door

You often find automatic door control systems at the entrance to supermarkets, public buildings, banks, hospitals etc.

8.2.1 Requirements of an automatic door

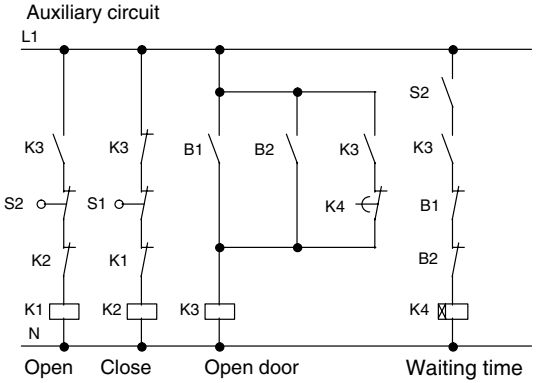
- When a person approaches the door, it must open automatically.
- The door must remain open until the doorway is cleared.
- When the doorway is cleared, the door must close automatically with a short delay.





The door is usually driven by a motor that is equipped with a slip coupling. This prevents people from being squeezed in and injured. The control system is connected to the mains via a master switch.

8.2.2 Conventional solution



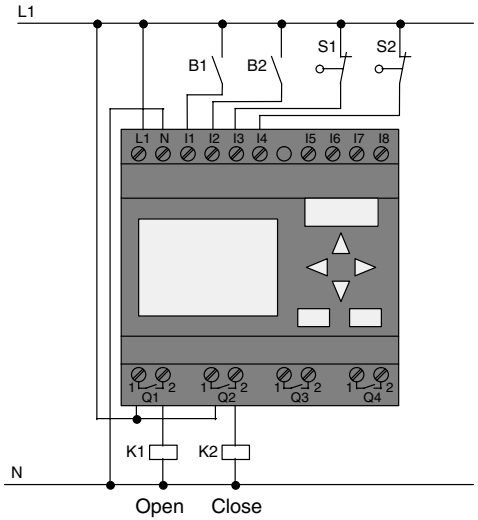
When someone enters the detection range of one of the motion sensors B1 or B2, the door opening motion is initiated by setting K3.

After the detection range of the two motion sensors has been cleared at least for a minimum time, K4 enables the closing motion.

8.2.3 Door control system with IDEC SmartRelay

IDEC SmartRelay can simplify this circuit considerably. You only need to connect the motion sensors, limit switches and the contactor relays to the IDEC SmartRelay.

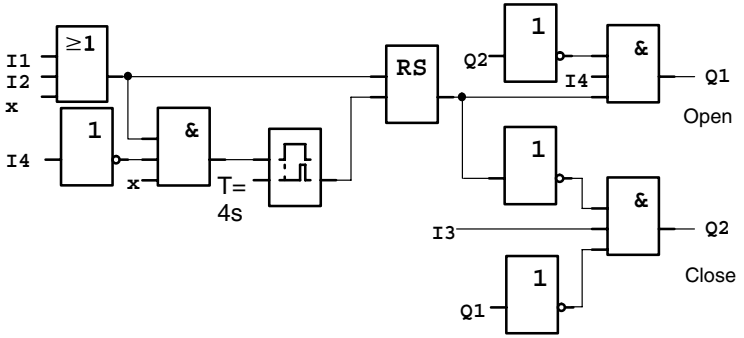
Wiring of a door control system with FL1E-H12RCC



Components used

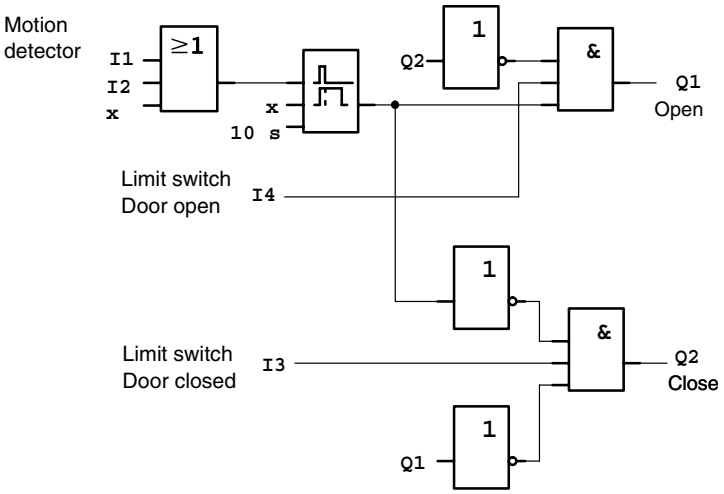
- K1 contactor relay *(open)*
- K2 contactor relay *(close)*
- S1 *(normally closed contact)* limit switch *(close)*
- S2 *(normally closed contact)* limit switch *(open)*
- B1 *(normally open contact)* infrared motion sensor *outside*
- B2 *(normally open contact)* infrared motion sensor *inside*

Door control system with IDEC SmartRelaycircuit diagram



This is what the circuit diagram of the conventional solution looks like.

You can simplify this circuit if you make use of the IDEC SmartRelay functions. You can use the off-delay function to replace the latching relay and the on-delay. The block diagram below illustrates this simplification:



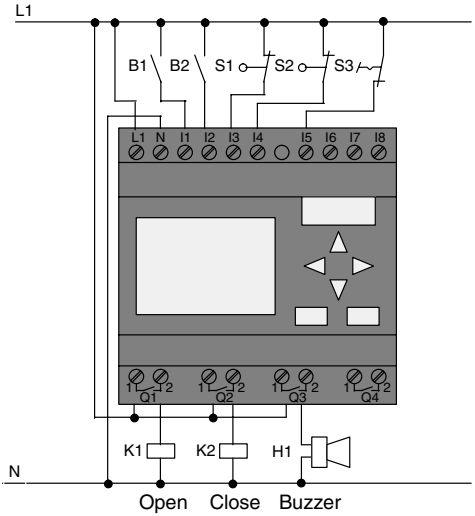
8.2.4 Special features and expansion options

Options for increasing comfort and user friendliness are, for example:

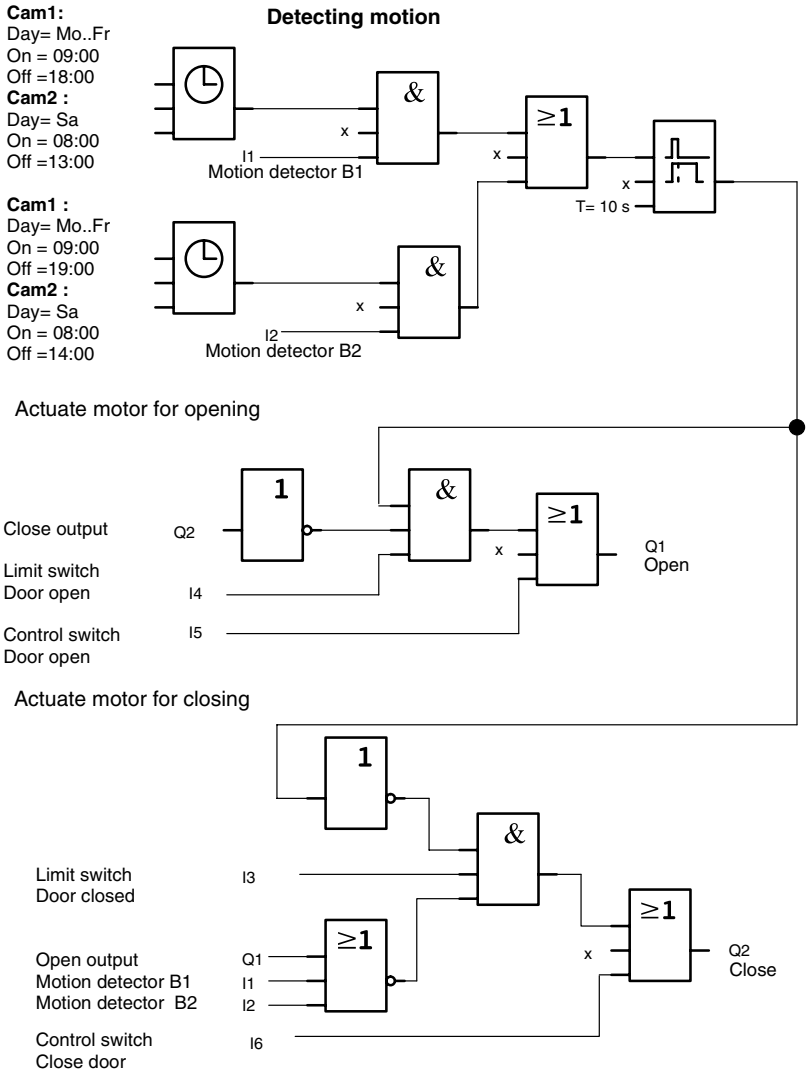
- You can connect an additional control switch with the positions: Open - Automatic - Closed (O-A-C)
- You can connect a buzzer to an output of the IDEC SmartRelay to warn of the closing of the door.
- You can enable opening of the door time and direction-dependent, i.e. opening only during business hours, and opening only from the inside after closing time.

8.2.5 Extended solution with FL1E-H12RCC

Wiring the IDEC SmartRelay extended solution



Block diagram of the extended IDEC SmartRelay solution



Detecting motion

During business hours, the motion detector B1 initiates the opening of the door when somebody wants to enter the shop. Motion detector B2 initiates the opening of the door when somebody wants to leave the shop.

After closing time, the motion detector B2 continues to be used to open the door for 1 hour to allow the customers to leave the shop.

Actuating the motor for opening

Output Q1 is set and opens the door when:

- The control switch at I5 is actuated (the door is permanently open), or
- The motion detectors indicate that somebody is approaching the door, and
- The door has not yet fully opened (limit switch at I4).

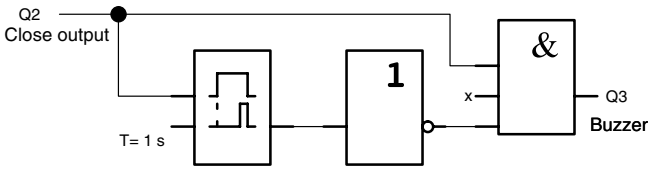
Actuating the motor for closing

Output Q2 is set to close the door when:

- The control switch at I6 is actuated (the door is permanently closed) or
- The motion detectors indicate that there is nobody near the door, and
- The door has not yet fully closed (limit switch at I3).

Buzzer

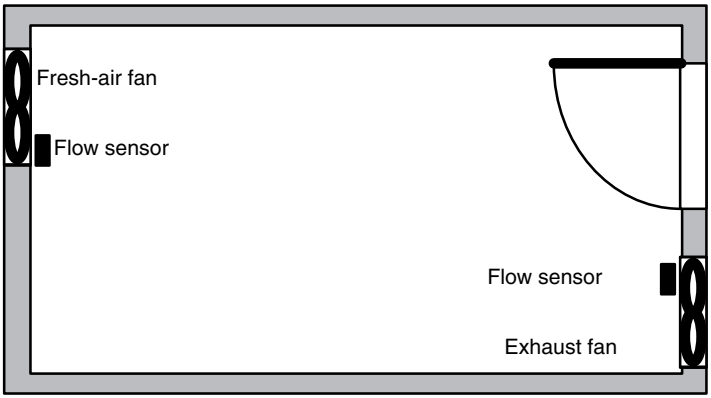
Connect the buzzer to output Q3. The buzzer gives a brief warning (in this case 1 second) when the door is closing. Enter the following circuit at Q3 in the circuit program:



8.3 Air-conditioning system

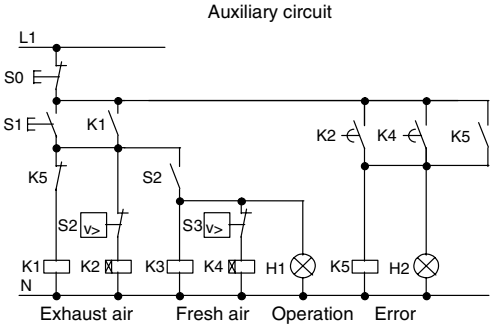
8.3.1 Requirements for an air-conditioning system

The air-conditioning system supplies fresh air to a room or exhausts the contaminated air from a room. Let us examine following example:



- The room is equipped with an exhaust fan and a fresh-air fan.
- Both fans are monitored by means of a flow sensor.
- An excess atmospheric pressure may never develop in the room.
- The fresh-air fan must only be switched on if safe functioning of the exhaust fan is signaled by the flow sensor.
- A warning lamp indicates failure of a fan.

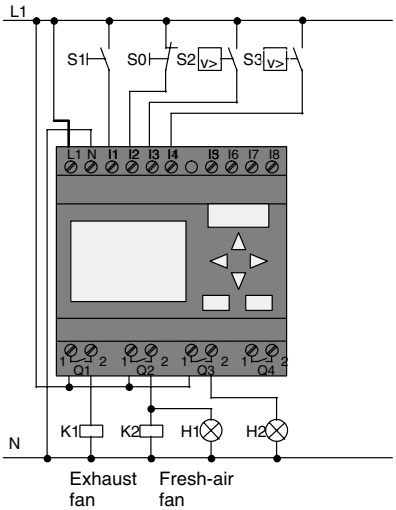
The circuit diagram for conventional solutions is as follows:



The fans are monitored by means of flow sensors. If no air flow is registered within a short waiting time, the system is switched off and an error message is output. This message can be acknowledged by pressing the OFF button.

In addition to the flow sensors, the fan monitoring system also requires an evaluating circuit with several switching devices. This evaluating circuit can be replaced by a single IDEC SmartRelay unit.

Wiring of an air-conditioning system with FL1E-H12RCC

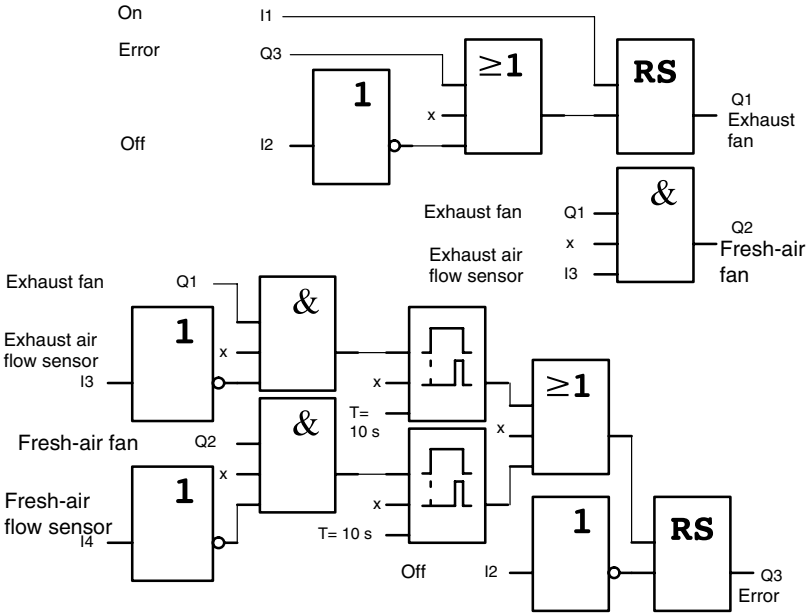


Components used

- K1 contactor relay
- K2 contactor relay
- S0 *(normally closed contact)* STOP pushbutton
- S1 *(normally open contact)* START pushbutton
- S2 *(normally open contact)* flow sensor
- S3 *(normally open contact)* flow sensor
- H1 signal lamp
- H2 signal lamp

Block diagram of the IDEC SmartRelay solution

The block diagram of the air-conditioning system with IDEC SmartRelay :



8.3.2 Advantages of using IDEC SmartRelay

The IDEC SmartRelay solution requires less switchgear. That saves you installation time and space in the control cabinet. You might even be able to use a smaller switching cabinet.

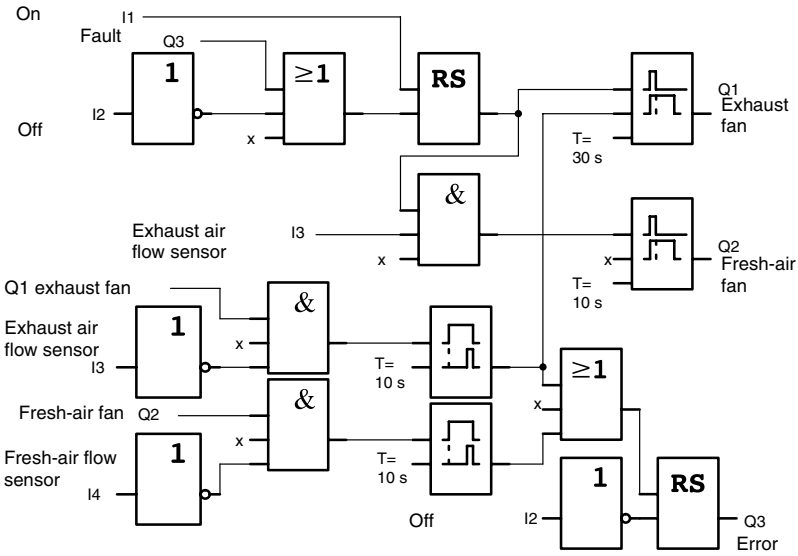
Additional IDEC SmartRelay options

- The free output (Q4) can be used as isolated signal contact for reporting faults or power failure.
- It is possible to switch off of the fans by means of a sequential circuit.

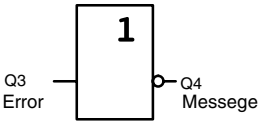
These functions can be implemented without additional switchgear.

Block diagram of the extended IDEC SmartRelay solution

The fans at Q1 and Q2 are switched on and off by means of the following circuit:

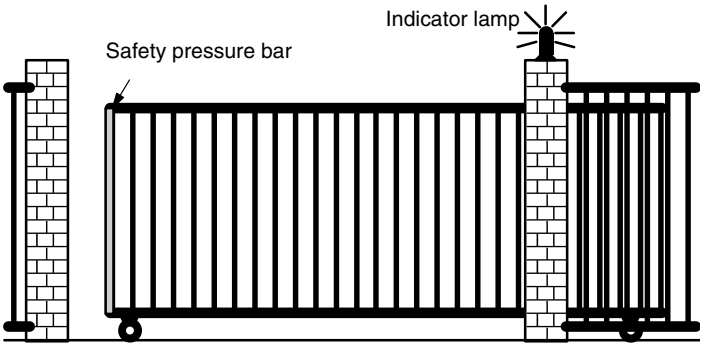


You can also generate a message at output Q4:



The relay contacts of output Q4 are always closed when the system is in operation. Relay Q4 does not drop off unless there is a power failure or a fault in the system. This contact can be used for remote monitoring, for example.

8.4 Factory door



The entrance to a company's premises is often closed with a gate. The gate is only opened to let vehicles in and out.

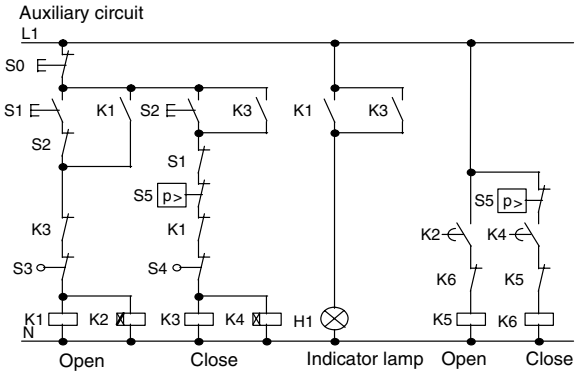
The gate is controlled by the porter.

8.4.1 Requirements for a gate control system

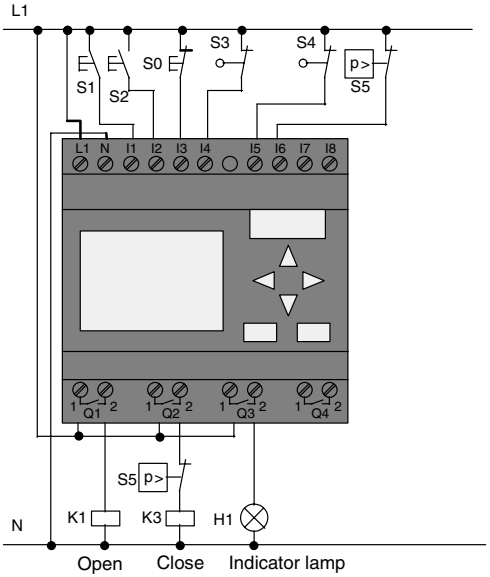
- The gate is opened and closed by means of pushbuttons in the gatehouse. The porter can monitor the operation of the gate at the same time.
- The gate is normally fully opened or fully closed. The gate motion can be interrupted at any time.
- An indicator lamp is switched on five seconds before the gate starts moving and when the gate is in motion.
- A safety pressure bar prevents harm to persons and objects from getting trapped or damaged when the gate is closing.

8.4.2 Previous solution

Various control systems are used to operate automatic gates. The circuit diagram below shows one of these options.



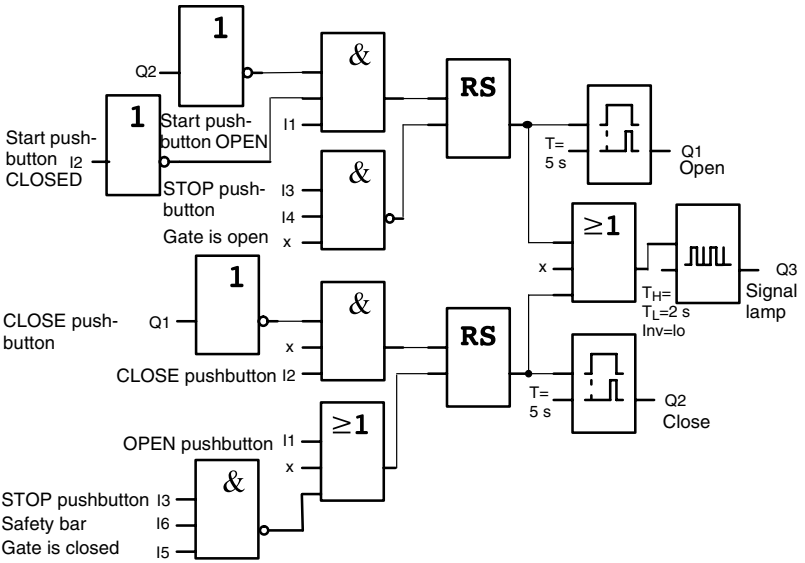
Wiring of a gate control system with FL1E-H12RCC



Components used

- K1 contactor relay
- K2 contactor relay
- S0 *(normally closed contact)* STOP pushbutton
- S1 *(normally open contact)* OPEN pushbutton
- S2 *(normally open contact)* CLOSE pushbutton
- S3 *(normally closed contact)* Position sensor OPEN
- S4 *(normally closed contact)* Position sensor CLOSED
- S5 *(normally closed contact)* Safety bar

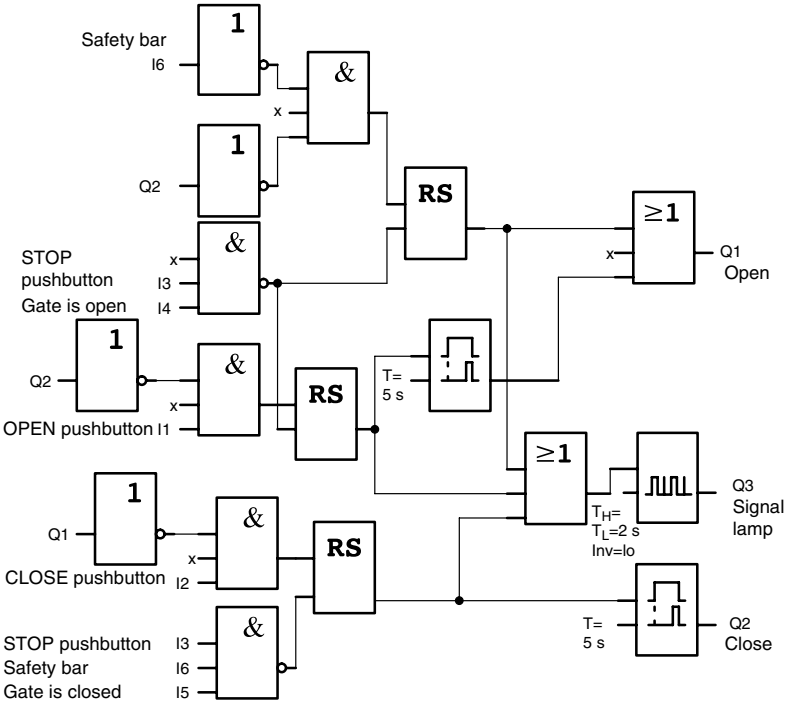
Block diagram of the IDEC SmartRelay solution



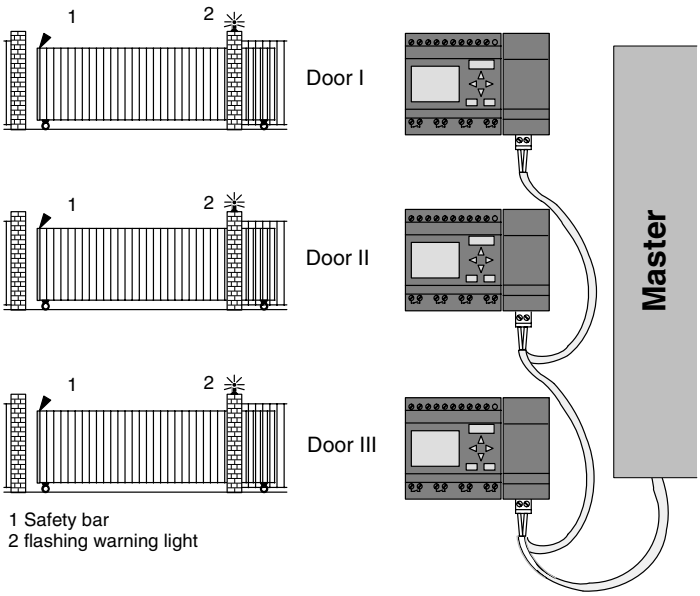
The OPEN or CLOSE pushbuttons initiate the gate motion, provided it is not already moving in the other direction. The gate is stopped by means of the STOP pushbutton or the relevant limit switch. A safety bar furthermore interrupts the closing motion of the gate.

8.4.3 Extended IDEC SmartRelay solution

Our extended control circuit is to open the gate automatically when the safety bar is actuated.



8.5 Centralized control and monitoring of several factory doors



Often, a company's premises can be entered at several locations. Not all of the gates can always be monitored locally by personnel. They must therefore be able to be monitored and operated by the porter who sits in a central gatehouse.

It must also be possible for a member of staff to open and close the gate locally.

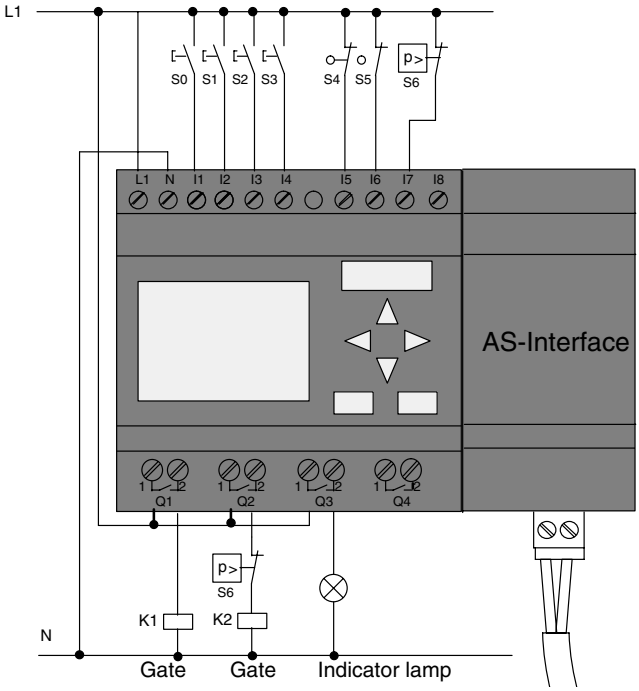
For **each** gate we are going to use one FL1E-H12RCC and one communication module. The modules and the master are interconnected by means of a bus system.

This chapter describes a gate control system. The structures of the other gate control systems are identical.

8.5.1 Requirements for a gate control system

- Every gate is opened and closed by means of a cord-operated switch. The gate is will be fully opened or fully closed.
- All gate can be opened and closed locally by means of pushbuttons.
- The gate can be opened and closed at the gatehouse by means of the bus system. The GATE OPEN or GATE CLOSED status is indicated.
- An indicator lamp is switched on five seconds before the gate starts moving and when the gate is in motion.
- A safety pressure bar prevents harm to persons and objects from getting trapped or damaged when the gate closes.

Wiring of the gate control system with FL1E-H12RCC and CM AS-Interface



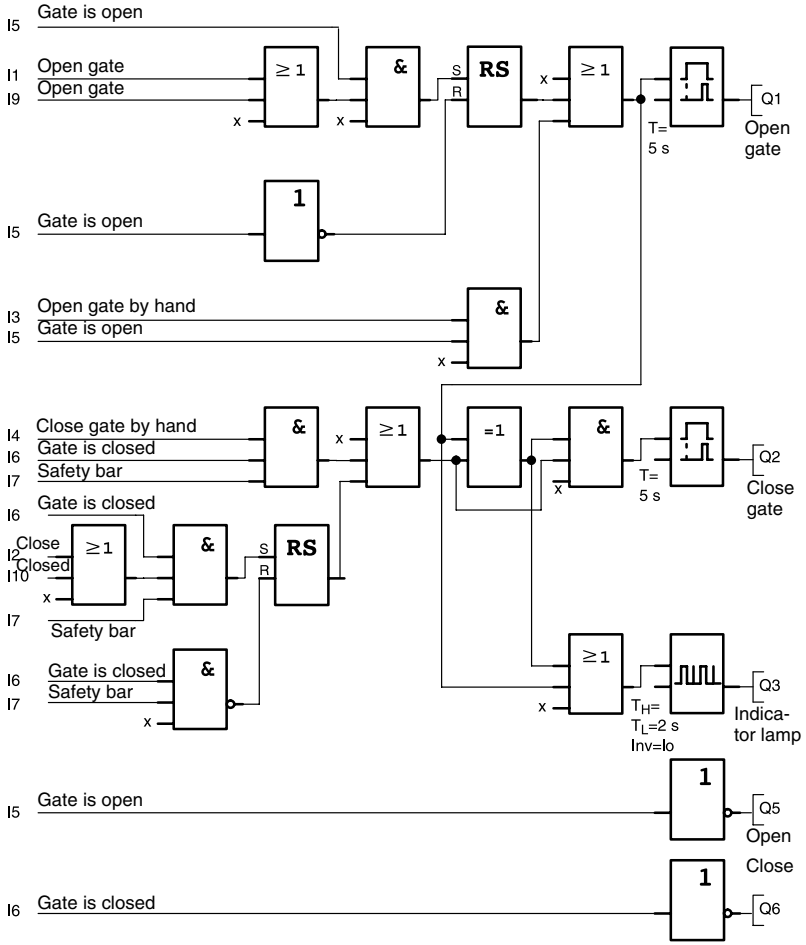
Components used

• K1	contactor relay open
• K2	contactor relay close
• S0 *(normally open contact)*	cord operated switch open
• S1 *(normally open contact)*	cord operated switch close
• S2 *(normally open contact)*	OPEN pushbutton
• S3 *(normally open contact)*	CLOSE pushbutton
• S4 *(normally closed contact)*	position sensor GATE IS OPEN
• S5 *(normally closed contact)*	position sensor GATE IS CLOSED
• S6 *(normally closed contact)*	Safety bar

Master control system

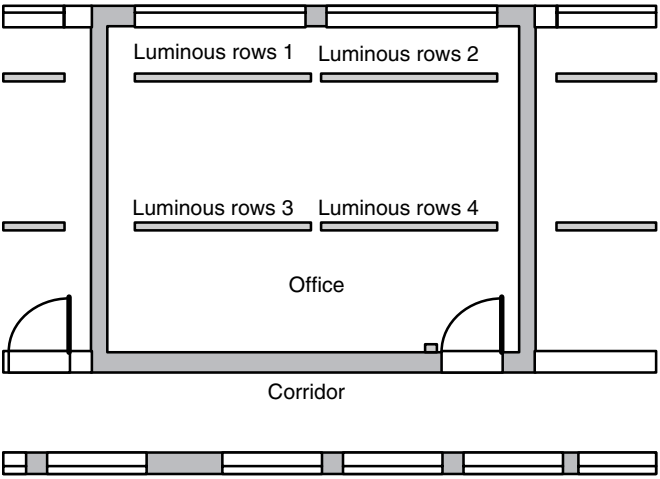
• Q5	position sensor GATE IS OPEN
• Q6	position sensor GATE IS CLOSED
• I9	external pushbutton OPEN GATE
• I10	external pushbutton CLOSE GATE

Block diagram of the IDEC SmartRelay solution



The OPEN GATE and CLOSE GATE pushbuttons initiate the gate motion, provided it is not already moving in the other direction. The gate motion ends at the respective limit switch. Closing of the gate is also interrupted by the safety bar.

8.6 Luminous rows

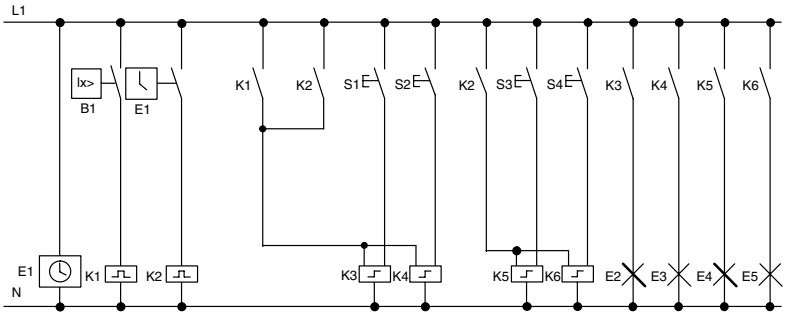


When planning lighting systems for commercial locations, the type and number of lamps used is determined by the luminance required. For reasons of cost efficiency, the installation often consists of fluorescent tubes arranged in luminous rows, and are divided into separate switching circuits, according to the way the room is used.

8.6.1 Requirements for a lighting system

- The various luminous rows are switched on and off locally.
- If there is sufficient daylight, the rows on the window side of the room are automatically switched off by means of a daylight control switch.
- The lights are switched off automatically at 20.00 h.
- Local manual operation of the lighting must be possible at all times.

8.6.2 Previous solution



The lamps are switched on and off with current impulse relays, by means of pushbutton control at the door. Regardless of this, they are reset with a timer or daylight control switch signal at the *central off* input. The pulse width of the off commands must be reduced by means of interval time-delay relays to allow operation of the lights after they are switched off.

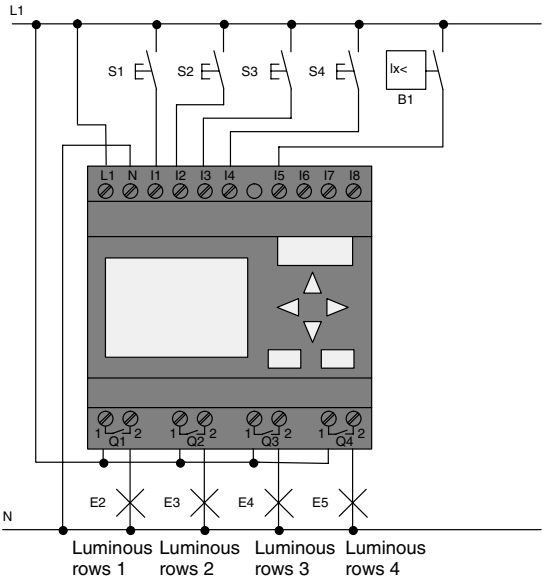
Components required:

- Pushbuttons S1 to S4
- Daylight control switch B1
- Timer E1
- Interval time-delay relays K1 and K2
- Pulse switches K3 to K6 with central OFF function

Disadvantages of the previous solution

- A substantial amount of switchgear needs to be installed to implement the necessary functions.
- Due to the large number of mechanical components, high wear and tear and maintenance expenditure is to be expected.
- The modification of functions involves considerable effort.

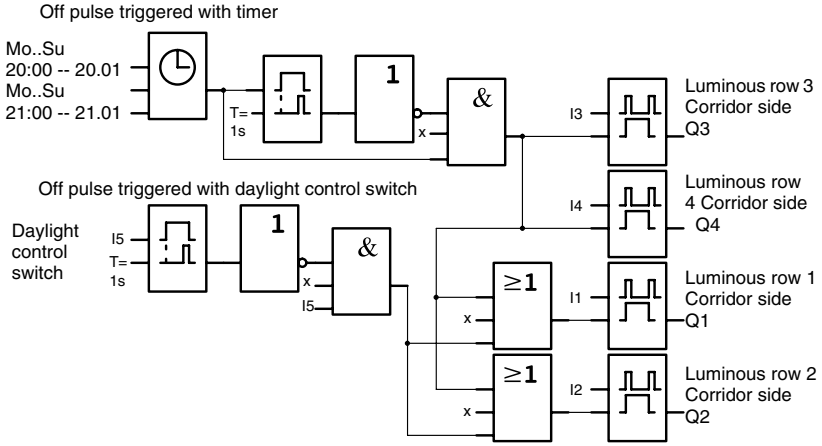
8.6.3 Luminous row control system with FL1E-H12RCC



Components used

- S1 to S4 *(normally open contact)*
  momentary pushbutton
- B1 *(normally open contact)*
  daylight control switch

Block diagram of the IDEC SmartRelay solution



Advantages of the IDEC SmartRelay solution

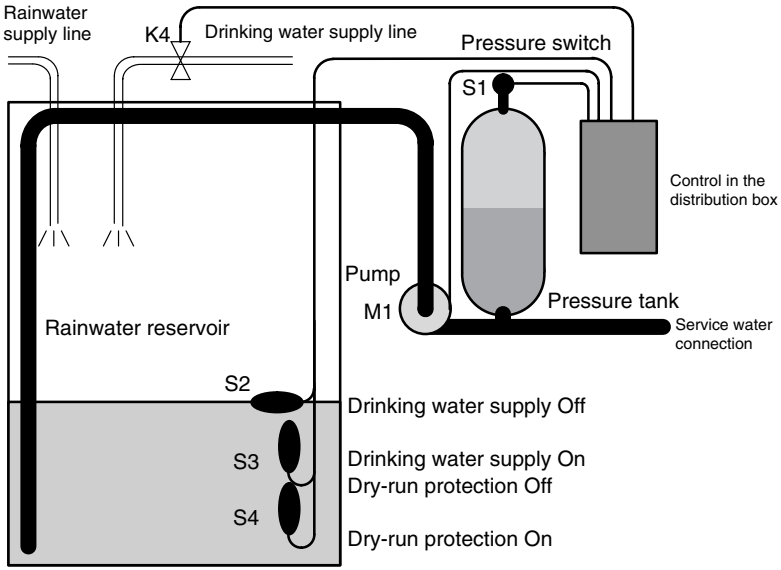
- You can connect the lamps directly to the IDEC SmartRelay, provided the power consumption does not exceed the switching capacity of the various outputs. Higher loads should be switched with a contactor relay.
- Connect the daylight control switch directly to an input of the IDEC SmartRelay.
- You do not need an external timer, because this function is integrated in the IDEC SmartRelay.
- Due to the reduced amount of switchgear, you can install a smaller and space-saving distribution cabinet.
- Fewer devices are required
- The lighting system can be easily modified.
- Additional switching times can be set as required (sequential circuit for the off pulses at the end of the day).
- The function of the daylight control switch can be easily applied to all lamps or to a modified group of lamps.

8.7 Service water pump

The use of rainwater as an addition to the drinking water supply is gaining importance. This saves cost and helps to protect the environment. For example, rainwater can be used for:

- Washing clothes
- Irrigation system for gardens
- Watering indoor plants
- Car wash
- Toilet flushing installations

The sketch below illustrates how such a rainwater utilization system is operated:

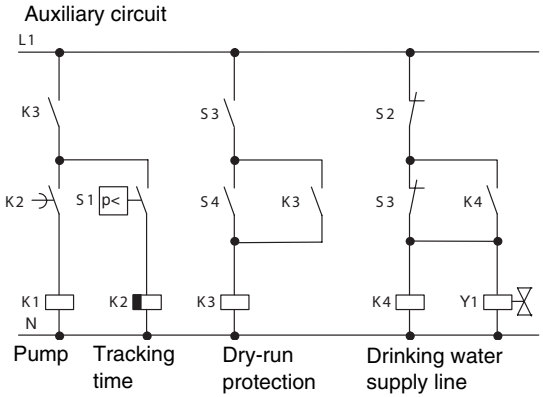


The rainwater is collected in a reservoir. From the reservoir, a pumping station supplies a respective line system. From there it can be tapped in the same way as normal drinking water. If the reservoir should run dry it can be topped up with drinking water.

8.7.1 Requirements for a control system of a service water pump

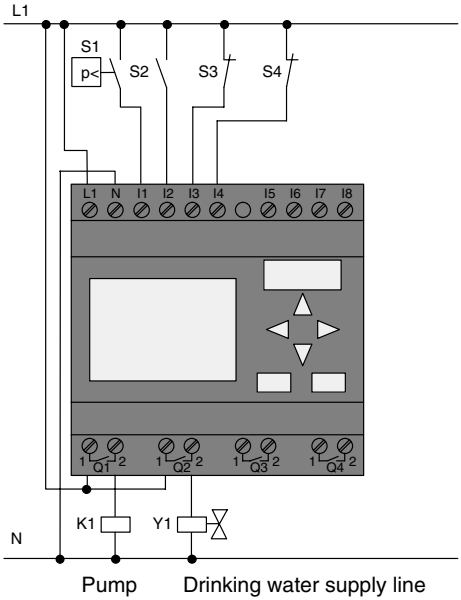
- Service water must be available at all times. In case of emergency, the control system must automatically switch over to drinking water supply.
- When switching over to the drinking water supply, the ingress of rainwater into the drinking water system must be prevented.
- The service water pump may not be switched on if the reservoir has run low of rainwater (dry-run protection).

8.7.2 Previous solution



The pump and a solenoid valve are controlled by means of a pressure switch and 3 float switches, which are installed in the rainwater reservoir. The pump must be switched on when the pressure level in the boiler drops below minimum. After the operating pressure is reached, the pump is switched off again after a tracking time of a few seconds has expired. The tracking time prevents oscillation of the water pump if water is drawn off over a longer period of time.

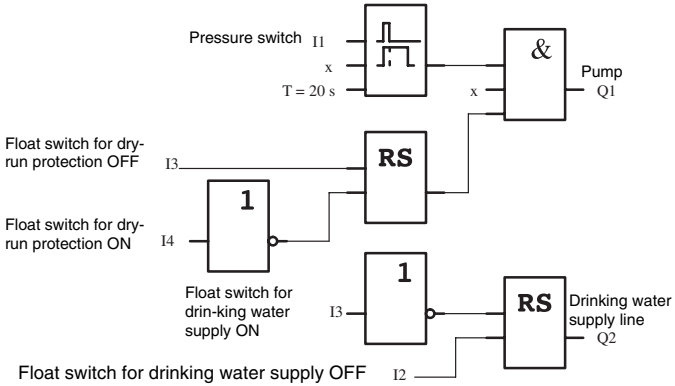
8.7.3 Service water pump system with FL1E-H12RCC



Apart from the IDEC SmartRelay, all you need is a pressure switch and the float switches to control the pump. If you are using a 3-phase AC motor, you must use a contactor relay to switch the pump. For single-phase AC pump systems you must provide a contactor relay if the power consumption of the AC motor exceeds the capacity of the output relay Q1. The power consumption of a solenoid valve is usually low enough to allow direct controlling.

- K1 contactor relay
- Y1 solenoid valve
- S1 *(normally open contact)* pressure switch
- S2 *(normally open contact)* float switch
- S3 *(normally closed contact)* float switch
- S4 *(normally closed contact)* float switch

Block diagram of the IDEC SmartRelay solution



8.7.4 Special features and expansions

The block diagram shows how you can interconnect the pump controls and the solenoid valve. The layout corresponds with the circuit diagram. You also have the option to integrate further functions for specific applications, which can only be implemented in a conventional circuitry by adding further switchgear, e.g.:

- Enabling the pump at specific times
- Indication of imminent or existing water shortage
- Reporting of system faults

Technical data

A

A.1 General technical data

Criterion	Tested in accordance with	Values
IDEC SmartRelay Base Dimensions (WxHxD) Weight Installation		72 x 90 x 55 mm Approx. 190 g on a 35 mm profile rail 4 module widths or wall mounting
IDEC SmartRelay expansion modules Dimensions (WxHxD) Weight Installation		36 x 90 x 53 mm Approx. 90 g on a 35 mm profile rail 2 module widths or wall mounting
Text Display		128.2 x 86 x 38.7 mm Approx. 220g Bracket mounting
Climatic conditions		
Ambient temperature Horizontal installation Vertical installation	Low temperature to IEC 60068-2-1 High temperature to IEC 60068-2-2	 0 ... 55 °C 0 ... 55 °C
Storage/shipping		-40 °C ... +70 °C
Relative humidity	IEC 60068-2-30	From 10 to 95 % no condensation
Air pressure		795 ... 1080 hPa
Pollutants	IEC 60068-2-42 IEC 60068-2-43	SO_2 10 cm^3 /m^3, 10 days H_2S 1 cm^3 /m^3, 10 days
Ambient mechanical conditions		
Degree of protection		IP 20 for IDEC SmartRelay base modules, expansion modules and Text Display excluding the Text Display front panel IP 65 / UL type 4x / 12 for Text Display front panel
Vibrations:	IEC 60068-2-6	5 ... 8.4 Hz (constant amplitude 3.5 mm) 8.4 ... 150 Hz (constant acceleration 1 g)

Criterion	Tested in accordance with	Values
Shock	IEC 60068-2-27	18 shocks (half-sine wave 15g/11 ms)
Free fall (packaged)	IEC 60068-2-32	0.3 m
Electromagnetic compatibility (EMC)		
Noise emission	EN 55011/A EN 55022/B EN 50081-1 (domestic area)	Limit class B group 1
Electrostatic discharge	IEC 61000-4-2 Severity 3	8 kV air discharge 6 kV contact discharge
Electromagnetic fields	IEC 61000-4-3	Field strength 1 V/m and 10 V/m
HF currents on cables and cable shielding	IEC 61000-4-6	10 V
Burst pulses	IEC 61000-4-4 Severity 3	2 kV (supply and signal lines)
High-energy surge pulse (applies only to FL1E-H12RCC/ FL1E-B12RCC)	IEC 61000-4-5 Severity 3	1 kV (power lines) symmetrical 2 kV (power lines) asymmetrical
Safety to IEC		
Clearance and creepage distance rating	IEC 60664, IEC 61131-2, EN 50178 cULus to UL 508, CSA C22.2 No. 142 With FL1E-H12RCC/ FL1E-B12RCC, also IEC60730-1	Fulfilled
Insulation strength	IEC 61131-2	Fulfilled
Cycle time		
Cycle time per function		< 0.1 ms
Startup		
Startup time at power-up		typ. 9 s

Note: Use a surge absorber, noise cut transformer, or noise filter to protect products rated at 12/24V DC or 24V DC power type modules against surge.

A.2 Technical data: FL1E-H12RCC/FL1E-B12RCC

	FL1E-H12RCC **FL1E-B12RCC**
Power supply	
Input voltage	100...240 V AC/DC
Permissible range	85 ... 265 V AC 100 ... 253 V DC
Permissible mains frequency	47 ... 63 Hz
Power consumption • 100 V AC • 240 V AC • 100 V DC • 240 V DC	 25 ... 40 mA 20 ... 30 mA 10 ... 25 mA 6 ... 15 mA
Voltage failure buffering • 100 V AC/DC • 240 V AC/DC	 typ. 10 ms typ. 20 ms
Power loss at • 100 V AC • 240 V AC • 100 V DC • 240 V DC	 2.8 ... 4.6 VA 4.8 ... 7.2 VA 1.1... 2.9 W 1.4 ... 3.6 W
Backup of the real-time clock at 25 °C	typ. 80 hours without battery cartridge typ. 2 years with battery cartridge
Accuracy of the real-time clock	typ. ±2 s / day
Digital inputs	
Number	8
Electrical isolation	No
High speed inputs	not applicable for this module
Input frequency • Normal input • High speed input	 • max. 4 Hz • not applicable for this module
Input voltage L1 • Signal 0 • Signal 1 • Signal 0 • Signal 1	 < 40 V AC > 79 V AC < 30 V DC > 79 V DC
Input current at • Signal 0 • Signal 1 • Signal 0 • Signal 1	 < 0.03 mA AC > 0.08 mA AC < 0.03 mA DC > 0.12 mA DC

	FL1E-H12RCC **FL1E-B12RCC**
Delay time at • 0 to 1 : 120 V AC : 240 V AC : 120 V DC : 240 V DC • 1 to 0 : 120 V AC : 240 V AC : 120 V DC : 240 V DC	 typ. 50 ms typ. 30 ms typ. 25 ms typ. 15 ms typ. 65 ms typ. 105 ms typ. 95 ms typ. 125 ms
Line length (unshielded)	max. 100 m
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1minute 500 V DC, 1 minute
In groups of	1
Control of a digital input	Yes
Continuous current I_{th}	max. 10 A per relay
Surge current	max. 30 A
Incandescent lamp load (25000 switching cycles) at • 230/240 V AC • 100/110 V AC	 1000 W 500 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W (at 230/240 V AC)
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W (at 230/240 V AC)
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W (at 230/240 V AC)
Short circuit–proof cos 1	Power protection B16, 600A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900A
Derating	none; across the entire temperature range
Parallel output circuits for power increase	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)

	FL1E-H12RCC **FL1E-B12RCC**
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz

Notice: For fluorescent lamps with capacitors, the technical data of fluorescent lamp ballasts must also be considered. If the maximum allowed surge current is exceeded, fluorescent lamps must be switched with appropriate contactor relays.

A.3 Technical data: FL1B-M08C2R2

	FL1B-M08C2R2
Power supply	
Input voltage	100...240 V AC/DC
Permissible range	85 ... 265 V AC 100 ... 253 V DC
Permissible mains frequency	47 ... 63 Hz
Power consumption • 100 V AC • 240 V AC • 100 V DC • 240 V DC	 34 ... 45 mA 30 ... 32 mA 5 ... 15 mA 5 ... 10 mA
Voltage failure buffering • 100 V AC/DC • 240 V AC/DC	 typ. 10 ms typ. 20 ms
Power loss at • 100 V AC • 240 V AC • 100 V DC • 240 V DC	 3.9 ... 4.1 VA 7.4 ... 7.6 VA 0.5 ... 1.8 W 1.2 ... 2.4 W
Backup of the real-time clock at 25 °C	
Accuracy of the real-time clock	
Digital inputs	
Number	4
Electrical isolation	No
High speed inputs	not applicable for this module
Input frequency • Normal input • High speed input	 • max. 4 Hz • not applicable for this module
Input voltage L1 • Signal 0 • Signal 1 • Signal 0 • Signal 1	 < 40 V AC > 79 V AC < 30 V DC > 79 V DC
Input current at • Signal 0 • Signal 1 • Signal 0 • Signal 1	 < 0.03 mA AC > 0.08 mA AC < 0.03 mA DC > 0.12 mA DC

	FL1B-M08C2R2
Delay time at • 0 to 1 : 120 V AC : 240 V AC : 120 V DC : 240 V DC • 1 to 0 : 120 V AC : 240 V AC : 120 V DC : 240 V DC	 typ. 50 ms typ. 30 ms typ. 25 ms typ. 15 ms typ. 65 ms typ. 105 ms typ. 95 ms typ. 125 ms
Line length (unshielded)	max. 100 m
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1minute 500 V DC, 1 minute
In groups of	1
Control of a digital input	Yes
Continuous current I_{th}	max. 5 A per relay
Surge current	max. 30 A
Incandescent lamp load (25000 switching cycles) at 230/240 V AC 100/110 V AC	 1000 W 500 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W (at 230/240 V AC)
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W (at 230/240 V AC)
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W (at 230/240 V AC)
Short circuit-proof cos 1	Power protection B16, 600A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900A
Derating	none; across the entire temperature range
Parallel output circuits for power increase	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)

	FL1B-M08C2R2
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz

Notice: For fluorescent lamps with capacitors, the technical data of fluorescent lamp ballasts must also be considered. If the maximum allowed surge current is exceeded, fluorescent lamps must be switched with appropriate contactor relays.

A.4 Technical data: FL1E-H12SND

	FL1E-H12SND
Power supply	
Input voltage	24 V DC
Permissible range	20.4 ... 28.8 V DC
Reverse polarity protection	Yes
Permissible mains frequency	not applicable for this module
Power consumption from 24 V DC	40 ... 75 mA 0.3 A per output
Voltage failure buffering	
Power loss at 24 V	1.0 ... 1.8 W
Backup of the real-time clock at 25°C (1)	typ. 80 hours without battery cartridge typ. 2 years with battery cartridge
Accuracy of the real-time clock (1)	typ. ±2 s / day
Digital inputs	
Number	8
Electrical isolation	No
High speed inputs	4 (I3, I4, I5, I6)
Input frequency • Normal input • High speed input	 • max. 4 Hz • max. 5 kHz
Input voltage • Signal 0 • Signal 1	L+ < 5 V DC > 12 V DC
Input current at • Signal 0 • Signal 1	 < 0.85 mA (I3...I6) < 0.05 mA (I1, I2, I7, I8) > 2 mA (I3... I6) > 0.15 mA (I1, I2, I7, I8)
Delay time at • 0 to 1 • 1 to 0	 typ. 1.5 ms <1.0 ms (I3 ... I6) typ. 1.5 ms <1.0 ms (I3 ... I6)
Line length (unshielded)	max. 100 m
Analog inputs	
Number	4 (I1=AI3, I2=AI4, I7=AI1, I8=AI2)
Range	0 ... 10 V DC input impedance 72 kΩ
Cycle time for analog value generation	300 ms
max. input voltage	28.8 V

	FL1E-H12SND
Line length (shielded and twisted)	max. 10 m
Error limit	+/- 1.5% at full scale
Digital outputs	
Number	4
Output type	Transistor, current-sourcing (2)
Electrical isolation	No
In groups of	
Control of a digital input	Yes
Output voltage	≙ Supply voltage
Output current	max. 0.3 A
Short circuit-proof and overload-proof	Yes
Short circuit current limitation	Approx. 1 A
Derating	none; across the entire temperature range
Short circuit-proof cos 1	not applicable for this module
Short circuit-proof cos 0.5 to 0.7	not applicable for this module
Parallel output circuit for power increase	Not permitted
Protection of output relay (if desired)	
Switching rate (3)	
Mechanical	not applicable for this module
Electrical	10 Hz
Ohmic load/lamp load	10 Hz
Inductive load	0.5 Hz

(1): Specification for FL1E-H12SND (version 5 or later). FL1E-H12SND (version 4 or earlier) does not have a real-time clock.

(2): When FL1E-H12SND or FL1B-M08B1S2 are switched on, signal 1 is sent to the digital outputs for about 50 microseconds. Take this into account, especially when using devices that react to short pulses.

(3) The maximum switching rate is only dependent on the switching program's cycle time.

A.5 Technical data: FL1B-M08B1S2

	FL1B-M08B1S2
Power supply	
Input voltage	24 V DC
Permissible range	20.4 ... 28.8 V DC
Reverse polarity protection	Yes
Permissible mains frequency	not applicable for this module
Power consumption from 24 V DC	30 ... 45 mA 0.3 A per output
Voltage failure buffering	
Power loss at 24 V	0.8 ... 1.1 W
Backup of the real-time clock at 25 °C	no clock available
Accuracy of the real-time clock	no clock available
Digital inputs	
Number	4
Electrical isolation	No
Input voltage • Signal 0 • Signal 1	L+ < 5 V DC > 12 V DC (1)
Input current at • Signal 0 • Signal 1	 < 0.85 mA (2) > 2 mA (3)
Delay time at • 0 to 1 • 1 to 0	 typ. 1.5 ms typ. 1.5 ms
Line length (unshielded)	max. 100 m
Digital outputs	
Number	4
Output type	Transistor, current-sourcing (4)
Electrical isolation	No
In groups of	
Control of a digital input	Yes
Output voltage	⏥ Supply voltage
Output current	max. 0.3 A
Short circuit-proof and overload-proof	Yes
Short circuit current limitation	Approx. 1 A
Derating	none; across the entire temperature range

	FL1B-M08B1S2
Short circuit–proof cos 1	not applicable for this module
Short circuit-proof cos 0.5 to 0.7	not applicable for this module
Parallel output circuit for power increase	Not permitted
Protection of output relay (if desired)	
Switching rate	
Mechanical	
Electrical	10 Hz
Ohmic load/lamp load	10 Hz
Inductive load	0.5 Hz

(1): 8 V DC (Version 1 to 4 specifications)
(2): 1.0 mA (Version 1 to 4 specifications)
(3): 1.5 mA (Version 1 to 4 specifications)
(4): When FL1E-H12SND or FL1B-M08B1S2 are switched on, signal 1 is sent to the digital outputs for about 50 microseconds. Take this into account, especially when using devices that react to short pulses.

A.6 Technical data: FL1E-H12RCA/FL1E-B12RCA

	FL1E-H12RCA **FL1E-B12RCA**
Power supply	
Input voltage	24 V AC/DC
Permissible range	20.4 ... 26.4 V AC 20.4 ... 28.8 V DC
Reverse polarity protection	not applicable for this module
Permissible mains frequency	47 ... 63 Hz
Power consumption • 24 V AC • 24 V DC	 76 ... 182 mA 40 ... 100 mA
Voltage failure buffering	typ. 5 ms
Power loss • 24 V AC • 24 V DC	 1.8... 4.4 VA 1.0 ... 2.4 W
Backup of the real-time clock at 25 °C	typ. 80 hours without battery cartridge typ. 2 years with battery cartridge
Accuracy of the real-time clock	typ. ±2 s / day

	FL1E-H12RCA **FL1E-B12RCA**
Digital inputs	
Number	8, optional P action or N action
Electrical isolation	No
High speed inputs	not applicable for this module
Input frequency • Normal input • High speed input	 • max. 4 Hz • not applicable for this module
Input voltage • Signal 0 • Signal 1	L < 5 V AC/DC > 12 V AC/DC
Input current at • Signal 0 • Signal 1	 < 1.0 mA > 2.5 mA
Delay time at • 0 to 1 • 1 to 0	 typ. 1.5 ms typ. 15 ms
Line length (unshielded)	max. 100 m
Analog inputs	
Number	
Range	
max. Input voltage	
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1minute 500 V DC, 1 minute
In groups of	1
Control of a digital input	Yes
Continuous current I_{th}	max. 10 A per relay
Surge current	max. 30 A
Incandescent lamp load (25000 switching cycles) at	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W

	FL1E-H12RCA **FL1E-B12RCA**
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W
Derating	none; across the entire temperature range
Short circuit-proof cos 1	Power protection B16, 600A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900A
Parallel output circuits for power increase	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz

Notice: For fluorescent lamps with capacitors, the technical data of fluorescent lamp ballasts must also be considered. If the maximum allowed surge current is exceeded, fluorescent lamps must be switched with appropriate contactor relays.

A.7 Technical data: FL1B-M08D2R2

	FL1B-M08D2R2
Power supply	
Input voltage	24 V AC/DC
Permissible range	20.4 ... 26.4 V AC 20.4 ... 28.8 V DC
Reverse polarity protection	not applicable for this module
Permissible mains frequency	47 ... 63 Hz
Power consumption • 24 V AC • 24 V DC	 120 ... 146 mA 20 ... 75 mA
Voltage failure buffering	typ. 5 ms
Power loss • 24 V AC • 24 V DC	 2.4 ... 4.3 VA 0.4 ... 1.8 W
Backup of the real-time clock at 25 °C	
Accuracy of the real-time clock	
Digital inputs	
Number	4, optional P action or N action
Electrical isolation	No
High speed inputs	not applicable for this module
Input frequency • Normal input • High speed input	 • max. 4 Hz • not applicable for this module
Input voltage • Signal 0 • Signal 1	L < 5 V AC/DC > 12 V AC/DC
Input current at • Signal 0 • Signal 1	 < 1.0 mA > 2.5 mA
Delay time at • 0 to 1 • 1 to 0	 typ. 1.5 ms typ. 15 ms
Line length (unshielded)	max. 100 m
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1 minute 500 V DC, 1 minute
In groups of	1

	FL1B-M08D2R2
Control of a digital input	Yes
Continuous current I_{th}	max. 5 A per relay
Surge current	max. 30 A
Incandescent lamp load (25000 switching cycles) at	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W
Derating	none; across the entire temperature range
Short circuit-proof cos 1	Power protection B16, 600A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900A
Parallel output circuits for power increase	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz

Notice: For fluorescent lamps with capacitors, the technical data of fluorescent lamp ballasts must also be considered. If the maximum allowed surge current is exceeded, fluorescent lamps must be switched with appropriate contactor relays.

A.8 Technical data: FL1E-H12RCE/ FL1E-B12RCE and FL1B-M08B2R2

	FL1E-H12RCE FL1E-B12RCE	FL1B-M08B2R2
Power supply		
Input voltage	12/24 V DC	12/24 V DC
Permissible range	10.8 ... 28.8 V DC	10.8 ... 28.8 V DC
Reverse polarity protection	Yes	Yes
Power consumption • 12 V DC • 24 V DC	 60 ... 175 mA 40 ... 100mA	 30 ... 140 mA 20 ... 75 mA
Voltage failure buffering • 12 V DC • 24 V DC	 typ. 2 ms typ. 5 ms	 typ. 2 ms typ. 5 ms
Power loss • 12 V DC • 24 V DC	 0.7 ... 2.1 W 1.0 ... 2.4 W	 0.3 ... 1.7 W 0.4 ... 1.8 W
Backup of the real-time clock at 25 °C	typ. 80 hours without battery cartridge typ. 2 years with battery cartridge	
Accuracy of the real-time clock	typ. ±2 s / day	
Electrical isolation	No	No
Digital inputs		
Number	8	4
Electrical isolation	No	No
High speed inputs	4 (I3, I4, I5, I6)	
Input frequency • Normal input • High speed input	 • max. 4 Hz • max. 5 kHz	 • max. 4 Hz • not applicable for this module
Input voltage L+ • Signal 0 • Signal 1	 < 5 V DC > 8.5 V DC	 < 5 V DC > 8.5 V DC (1)
Input current at • Signal 0 • Signal 1	 < 0.85 mA (I3...I6) < 0.05 mA (I1, I2, I7, I8) > 1.5 mA (I3... I6) > 0.1 mA (I1, I2, I7, I8)	 < 0.85 mA(2) > 1.5 mA
Delay time at • 0 to 1 • 1 to 0	typ. 1.5 ms <1.0 ms (I3 ... I6) typ. 1.5 ms <1.0 ms (I3 ... I6)	typ. 1.5 ms typ. 1.5 ms

	FL1E-H12RCE FL1E-B12RCE	FL1B-M08B2R2
Line length (unshielded)	max. 100 m	max. 100 m
Analog inputs		
Number	4 (I1=AI3, I2=AI4, I7=AI1, I8=AI2)	
Range	0 ... 10 V DC input impedance 72 kΩ	
Cycle time for analog value generation	300 ms	
max. Input voltage	28.8 V DC	
Line length (shielded and twisted)	max. 10 m	
Error limit	+/- 1.5 % at full scale	
Digital outputs		
Number	4	4
Output type	Relay outputs	Relay outputs
Electrical isolation	Yes	Yes
Dielectric Strength (between power/ input terminals and output terminals)	2,500 V AC, 1 minute 500 V DC, 1 minute	2,500 V AC, 1 minute 500 V DC, 1 minute
In groups of	1	1
Control of a digital input	Yes	Yes
Continuous current $I_{th\ (per\ terminal)}$	max. 10 A per relay	max. 5 A per relay
Surge current	max. 30 A	max. 30 A
Incandescent lamp load (25000 switching cycles) at	1000 W	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W	10 x 58 W
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W	1 x 58 W
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W	10 x 58 W
Derating	none; across the entire temperature range	none; across the entire temperature range
Short circuit-proof cos 1	Power protection B16, 600A	Power protection B16, 600A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900A	Power protection B16, 900A
Parallel output circuits for power increase	Not permitted	Not permitted

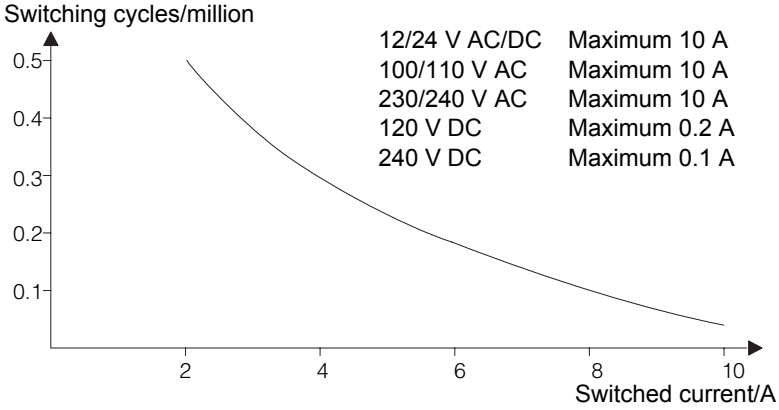
	FL1E-H12RCE **FL1E-B12RCE**	**FL1B-M08B2R2**
Protection of output relay (if desired)	max. 16 A, characteristic B16	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)	10,000,000 operations minimum (no load, 10 Hz)
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Switching rate		
Mechanical	10 Hz	10 Hz
Ohmic load/lamp load	2 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

Notice: For fluorescent lamps with capacitors, the technical data of fluorescent lamp ballasts must also be considered. If the maximum allowed surge current is exceeded, fluorescent lamps must be switched with appropriate contactor relays.

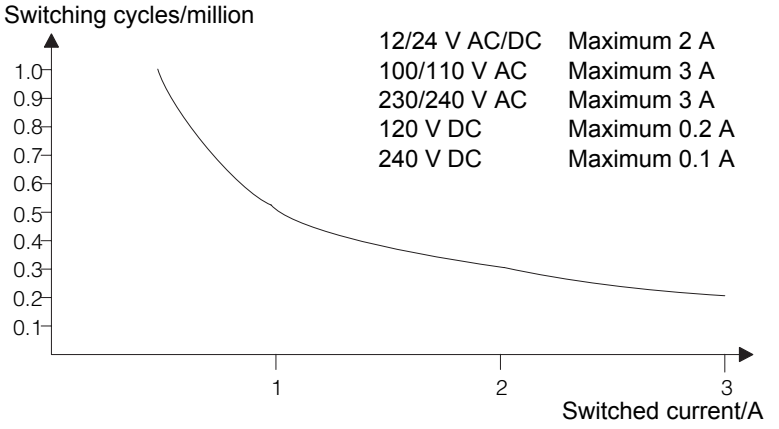
(1): 8 V DC (Version 1 to 5 specifications)
(2): 1.0 mA (Version 1 to 5 specifications)

A.9 Switching capacity and service life of the relay outputs

Switching capacity and service life of the contacts with ohmic load (heating):



Switching capacity and service life of the contacts with high inductive load to IEC 947-5-1 DC 13/AC 15 (contactors, solenoid coils, motors)



A.10 Technical data: FL1B-J2B2

	FL1B-J2B2
Power supply	
Input voltage	12/24 V DC
Permissible range	10.8 ... 28.8 V DC
Power consumption	25 ... 50 mA
Voltage failure buffering	typ. 5 ms
Power loss at • 12 V • 24 V	 0.3 ... 0.6 W 0.6 ... 1.2 W
Electrical isolation	No
Reverse polarity protection	Yes
Ground terminal	for connecting ground and shielding of the analog measuring line
Analog inputs	
Number	2
Type	Unipolar
Input range	0 ... 10 V DC (input impedance 76 kΩ) or 0/4 ... 20 mA (input impedance <250 Ω)
Resolution	10 bit, normalized to 0 ... 1000
Cycle time for analog value generation	50 ms
Electrical isolation	No
Line length (shielded and twisted)	max. 10 m
Encoder supply voltage	none
Error limit	+/- 1.5 %
Interference frequency suppression	55 Hz

A.11 Technical data: FL1D-K2B2, FL1D-K2BM2

	FL1D-K2B2	FL1D-K2BM2
Power supply		
Input voltage	24 V DC	24 V DC
Permissible range	20.4 ... 28.8 V DC	20.4 ... 28.8 V DC
Power consumption	25 ...50 mA	35 ...90 mA
Voltage failure buffering	typ. 5 ms	typ. 5 ms
Power loss at 24 V	0.6 ... 1.2 W	0.9 ... 2.2 W
Electrical isolation	No	No
Reverse polarity protection	Yes	Yes
Ground terminal	for connecting ground and shielding of the analog output line.	for connecting ground and shielding of the analog output line.
Analog outputs		
Number	2	2
Voltage range	0 ... 10 V DC	0 ... 10 V DC
Voltage load	>= 5 kΩ	>= 5 kΩ
Current output (1)	-	0/4 ... 20 mA
Current load (1)	-	<= 250 Ω
Resolution	10 bit, normalized to 0 ... 1000	10 bit, normalized to 0 ... 1000
Cycle time for analog output	depending on installation (typ. 50 ms)	depending on installation (typ. 50 ms)
Electrical isolation	No	No
Line length (shielded and twisted)	max. 10 m	max. 10 m
Error limit	Voltage output: +/- 2.5 % at full scale	Voltage output: +/- 2.5 % at full scale Current output: (1) +/- 3 % at full scale
Short circuit protection	Yes	Yes
Response at short-circuit	(2)	(2)
Overload protection	Yes	Yes
Response at overload	(2)	(2)

(1) The current output is only possible when the module is used with a FL1E.

(2) Voltage output: If short-circuit protection or overcurrent protection is activated for a voltage output, the error limit of the other voltage is not ensured.

A.12 Technical data: Text Display

	Text Display
Mechanical data	
Dimensions (WxHxD) Weight Installation	128.2 x 86 x 38.7 mm Approx. 220 g Bracket mounting
Keyboard Display	Membrane keypad with 10 keys FSTN-Graphic Display with 128 x 64 (columns x rows), LED backlight
Power supply	
Input voltage	24 V AC/DC 12 V DC
Permissible range	20.4 ... 26.4 V AC 10.2 ... 28.8 V DC
Permissible mains frequency	47 ... 63 Hz
Power consumption • 12 V DC • 24 V DC • 24 V AC	 typ. 65 mA typ. 40 mA typ. 90 mA
Data transmission rate	19200 baud
LCD Display and Backlight	
Backlight lifetime(1)	20,000 hours
Display lifetime(2)	50,000 hours

(1) Backlight lifetime is defined as: The final brightness is 50% of the original brightness.
(2) Display lifetime is calculated under ordinary operating and storage conditions: room temperature (20 +/-8°C), normal humidity below 65% relative humidity, and not in exposure to direct sunlight.

Determining the cycle time

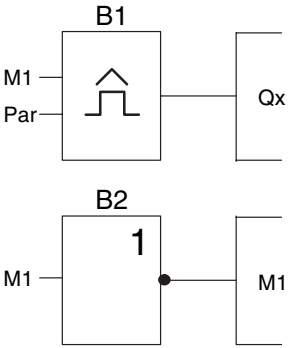
B

The program cycle is the complete execution of the circuit program, that is, primarily the reading in of the inputs, the processing of the circuit program and the subsequent reading out of the outputs. The cycle time is the time required to execute a circuit program once in full.

The time required for a program cycle can be determined using a short test program. This test program is created in IDEC SmartRelay and returns a value during its execution in parameter assignment mode from which the current cycle time is derived.

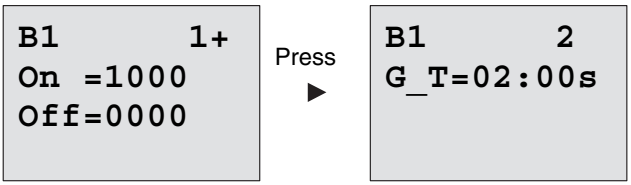
Test program

1. Create the test program by linking an output to a frequency trigger and connecting the trigger input with an inverted marker.

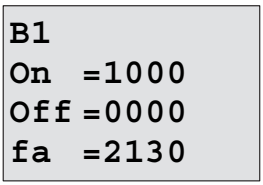


Output Qx or other marker Mx

2. Configure the frequency trigger as shown below. A pulse is generated in each program cycle due to the inverted marker. The trigger interval is set to 2 seconds.



3. Now start the circuit program and switch IDEC SmartRelay to parameter assignment mode. In this mode, view the trigger parameters.



f_a= total of measured pulses per timebase G_T

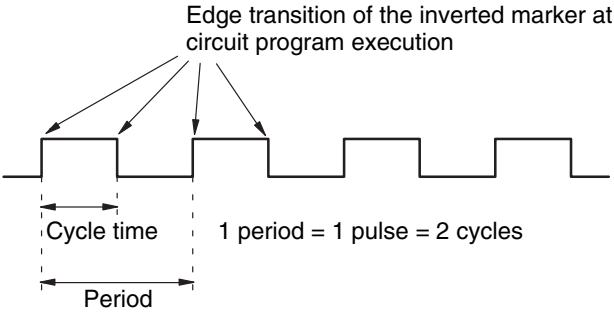
4. The reciprocal value of f_a is equivalent to the IDEC SmartRelay execution time of the current circuit program in its memory.

   $1/f_a$ = cycle time in s

Explanation

The inverted marker block changes its output signal at each program execution. Thus, one logic level (high or low) width is exactly equivalent to the length of one cycle. Hence, a period lasts 2 cycles.

The frequency trigger indicates the ratio of periods per 2 seconds, which results in the ratio of cycles per second.

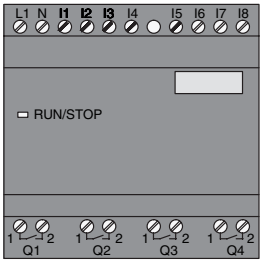


IDEC SmartRelay without display

C

Because some specific applications do not require operator control and monitoring units such as buttons or a display, we provide the FL1E-B12RCE, FL1E-B12RCA and FL1E-B12RCC versions without display.

View of a FL1E-B12RCC, for example:



Less is definitely more!

The versions without display offer you the following benefits:

- Even more cost-effective without the operating element
- Requires less switch cabinet space than conventional hardware
- Substantial benefits with regard to flexibility and prime costs compared to stand-alone electronic switchgear
- Of advantage even for applications in which merely two or three conventional switching devices can be replaced
- Very easy to use
- Access protected
- Compatible to IDEC SmartRelay versions with display
- Offers the option to read data by means of WindLGC

Creating a circuit program without operator panel

There are two ways to create a circuit program for an IDEC SmartRelay without display:

- You create the circuit program with WindLGC on your PC and then download it to IDEC SmartRelay (see Chapter 7).
- You download the circuit program from an IDEC SmartRelay memory cartridge or combined memory/battery cartridge to your IDEC SmartRelay without display (see Chapter 6).

Operating characteristics

IDEC SmartRelay is ready for operation when power is switched on. Switching off an IDEC SmartRelay without display is equivalent to disconnecting the power supply, e.g. as if you were removing the plug.

The circuit program of FL1E-B12... versions cannot be started or stopped by means of buttons. This is why the FL1E-B12... versions have other startup characteristics:

Startup characteristics

If there is no circuit program in IDEC SmartRelay or on the inserted memory cartridge or combined memory/battery cartridge, IDEC SmartRelay remains in STOP.

If there is a valid circuit program in IDEC SmartRelay memory, the IDEC SmartRelay automatically switches from STOP to RUN when power is switched on.

The circuit program on an inserted memory cartridge or combined memory/battery cartridge is automatically copied to IDEC SmartRelay, immediately after power is switched on. The existing circuit program in IDEC SmartRelay memory is overwritten. The system automatically changes from STOP to RUN.

Provided the PC cable is connected to IDEC SmartRelay, you can download the circuit program to IDEC SmartRelay and start it by means of WindLGC PC software (see Chapter 7.1).

Operating status indication

Operating states, e.g. Power On, RUN and STOP are indicated by an LED on the front hood.

- Red LED: Power On/STOP
- Green LED: Power On/RUN

The red LED is lit after Power On and in all IDEC SmartRelay states other than RUN. The green LED is lit when IDEC SmartRelay is in RUN mode.

Reading current data

WindLGC (see Chapter 7) provides an online test for reading the current data of all functions while the system is in RUN.

If your IDEC SmartRelay without display holds a protected memory cartridge or combined memory/battery cartridge, you cannot read the current data unless you enter the correct password for the circuit program. The circuit program is otherwise deleted from IDEC SmartRelay memory when you remove the memory cartridge or combined memory/battery cartridge to connect the PC cable. (See Chapter 6.1).

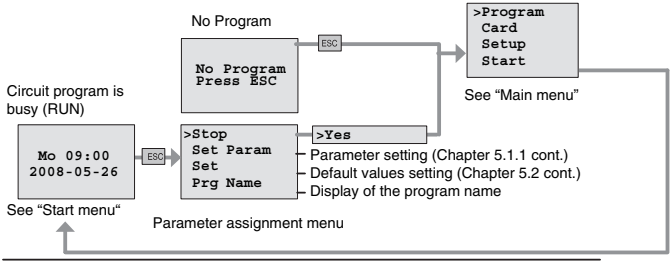
Deleting the circuit program

Use WindLGC to delete the circuit program and password if a password exists.

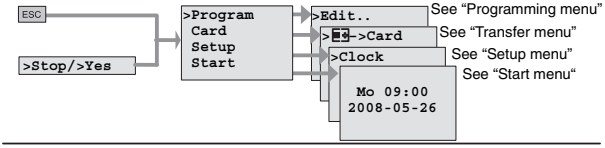
IDEC SmartRelay menu structure D

D.1 IDEC SmartRelay base module

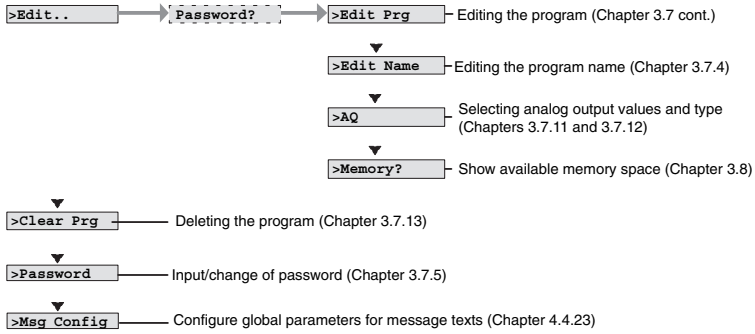
Menu overview



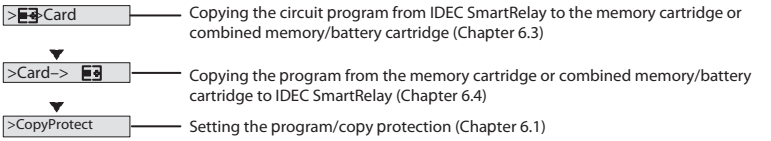
Main menu (ESC / >Stop)



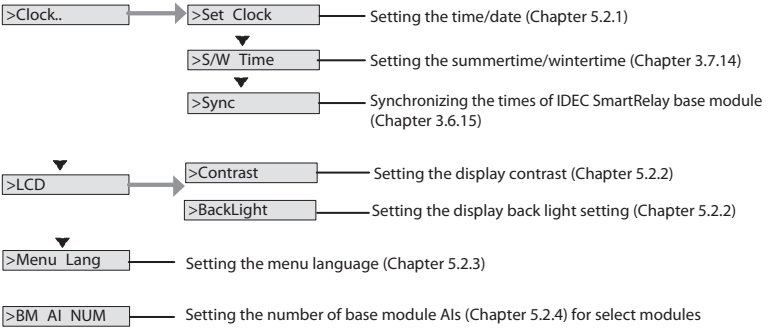
Programming menu (ESC / >Stop → >Program)



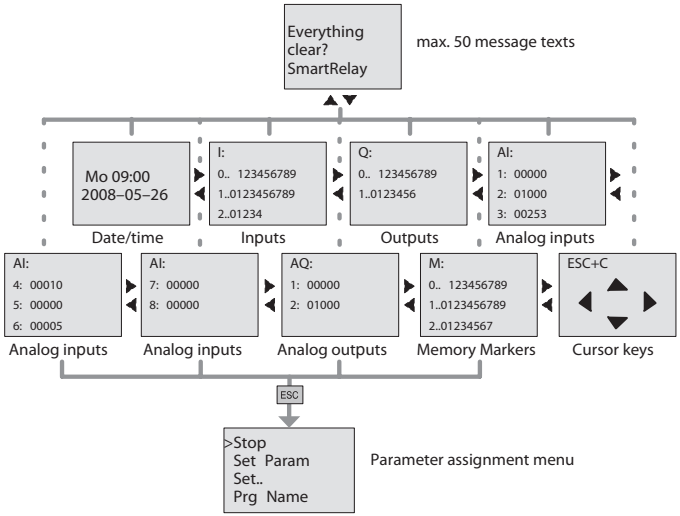
Transfer menu (ESC / >Stop ⟶ >Card)


>Card
Copying the circuit program from IDEC SmartRelay to the memory cartridge or combined memory/battery cartridge (Chapter 6.3)
>Card–>
Copying the program from the memory cartridge or combined memory/battery cartridge to IDEC SmartRelay (Chapter 6.4)
>CopyProtect
Setting the program/copy protection (Chapter 6.1)

Setup menu (ESC / >Stop ⟶ >Setup)

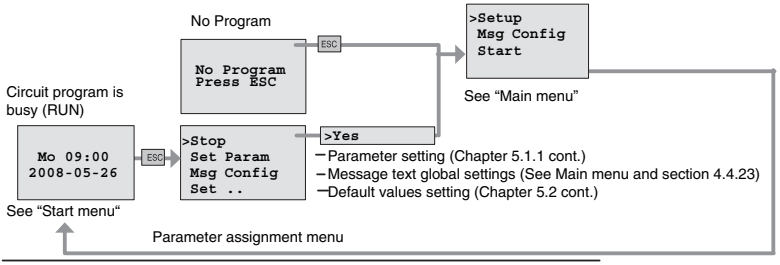

>Clock..
>Set Clock
Setting the time/date (Chapter 5.2.1)
>S/W Time
Setting the summertime/wintertime (Chapter 3.7.14)
>Sync
Synchronizing the times of IDEC SmartRelay base module (Chapter 3.6.15)
>LCD
>Contrast
Setting the display contrast (Chapter 5.2.2)
>BackLight
Setting the display back light setting (Chapter 5.2.2)
>Menu Lang
Setting the menu language (Chapter 5.2.3)
>BM AI NUM
Setting the number of base module AIs (Chapter 5.2.4) for select modules

Start Menu (RUN)

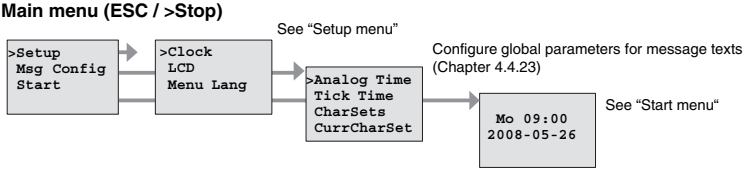


D.2 Text Display

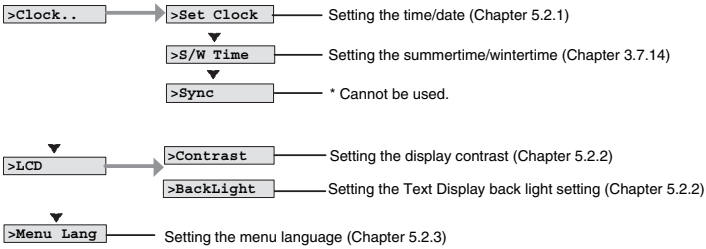
Menu overview



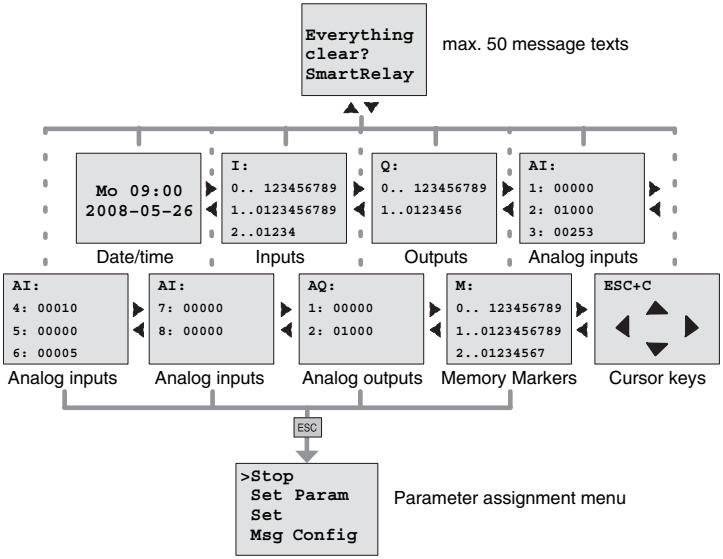
Main menu (ESC / >Stop)



Setup menu (ESC / >Stop → >Setup)



Start Menu (base module in RUN)



Type Numbers

E

Table A IDEC SmartRelay Modules

Name	Type Number	Rated Power Voltage	Input Type (Digital)	Input Type (Analog)	Output Type (Relay)	Output Type (Analog)	Display and Keypad	Real Time Clock
Base Module (IDEC SmartRelay Base or Pure)	FL1E-H12RCC	100-240V AC/DC	8	-	4	-	Yes	Yes
	FL1E-B12RCC						-	
	FL1E-H12RCA	24V AC/DC	8	-	4	-	Yes	Yes
	FL1E-B12RCA						-	
	FL1E-H12RCE	12/24V DC	8 (I1-I8)	4 (I1, I2, I7, I8)	4	-	Yes	Yes
	FL1E-B12RCE						-	
	FL1E-H12SND	24V DC	8 (I1-I8)	4 (I1, I2, I7, I8)	4 (Tr)	-	Yes	*1
Expansion Module	FL1B-M08B2R2	12/24V DC	4	-	4	-	-	-
	FL1B-M08B1S2	24V DC	4	-	4 (Tr)	-	-	-
	FL1B-M08C2R2	100-240V AC/DC	4	-	4	-	-	-
	FL1B-M08D2R2	24V AC/DC	4	-	4	-	-	-
	FL1B-J2B2	12/24V DC	-	2	-	-	-	-
	FL1D-K2B2	24V DC	-	-	-	2(0-10V)	-	-
	FL1D-K2BM2	24V DC	-	-	-	2(0-10V, 0/4-20mA)	-	-
Text Display	FL1E-RD1	24V AC/DC 12V DC	-	-	-	-	Yes	-

Name	Type Number	Rated Power Voltage	Input Type (Digital)	Input Type (Analog)	Output Type (Relay)	Output Type (Analog)	Display and Keypad	Real Time Clock
AS-Interface Module	FL1B-CAS2	AS-Interface Voltage	-	-	-	-	-	-
LONWORKS® Module*2	FL1B-CL1C12	24V AC/DC	-	-	-	-	-	-

*1: Version 5 or later: FL1E-H12SND has a real-time clock.
Version 4 or earlier: FL1E-H12SND does not have a real-time clock.
*2: LONWORKS® is a registered trademark of Echelon company of United States.

Cable and Accessories Table B

Name	Function	Type Number
WindLGC	Exclusive Programming Software for IDEC SmartRelay (incl. Hardware/Software Manual)	FL9Y-LP1CDW
PC Cable	Down-load/Up-load Cable	FL1A-PC1
USB PC cable	Down-load/Up-load Cable	FL1E-PC2
Memory cartridge		FL1E-PM4
Battery cartridge		FL1E-PB1
Combined memory/ battery cartridge		FL1E-PG1
User's Manual	FL1E User's Manual (English)	FL9Y-B1090
Mounting Clip	5 pieces	FL1B-PSP1PN05
Removal Tool	Memory Cartridge Removal Tool	MT-101

Index

A

AIs in Base Module 244
AM See Analog module
Amplifier
  analog 185
Analog
  comparator 177
  values 125
Analog amplifier 185
Analog differential trigger 174
Analog math 225
Analog math error detection 230
Analog module 2, 11
Analog multiplexer 210
Analog output type 95
Analog output values 94
Analog outputs 46, 186
Analog ramp control 212
Analog trigger 171
Analog value monitoring 182
Analog watchdog 182
AND 115
Applications 263
AQ in Stop 94
AQ type 95
AS interface 3
AS interface bus
  communication failure 55
  communication states 55
  networking 49
Asynchronous pulse generator 142

B

Backlight 241
Backlight flags 112
Backlight lifetime
  Text Display 320
Basic functions 114
  AND 115
    with edge 116
  NAND 116
    with edge 117
  NOR 119
  NOT 120
  OR 118
  XOR 120
Basics on special functions 121
BF 109
blank outputs 111
Block 60
  deleting 92
    block groups 93
  inserting 87
  number 60
    assigning 61
BM AI NUM 244
BN 109

C

Cap 26
Card See Program module (card)
CE label 14
Certification 14
Ch by Ch ticking 199
Character set flag 112
Character sets 193
Chinese character set 195
Circuit diagram 63
Circuit program
  input 72
circuit program 103
  deleting 96
Circuit program name

assigning 77
Circuit program size 103
Circuit programs
archiving 247
reproduce 247
send by mail 248
Closing the programming mode 91
CM See Communications module
Co 109, 110
Combined memory/battery cartridge 247
Communication module
AS interface 3
Communication modules 3
Communications module
AS interface 11
Compatibility
Versions 249
Connecting
AS interface bus 49
Inputs 35
outputs 44
Connector 26
Connectors 58, 110
hi 59
IDEC SmartRelay 59
inputs 59
lo 59
open 113
outputs 59
unused 59, 64
x 59, 64, 122
Constants 110
Conversion
Summertime and wintertime 97
Correcting typing errors 94
Counter
Operating hours 164
Up/down 161
CSA 14
cULus 14
Current impulse relay 191
Cursor 67
Cursor keys 58, 112, 204
Cursor movement 67
Cycle time 321

D

Days of the week 152
Default values 239
Detection of math error
Analog amplifier 230
Device types
IDEC SmartRelay 2
Digital module 2, 11
Dimensions 25
DIN rail 25
Display 61
Display contrast 241
Display lifetime
Text Display 320
Display modules 2
Disposal 15
Divide by 0 error 230
DM8... See Digital module
Dual-function switch 148

E

Earth connection 33
Edge evaluation 116, 117
Edge-triggered interval time-delay relay 140
Editing 87
Errors, analog math 230
Example
Air-conditioning system 276
Automatic door 269

Factory door 281
factory door
controlling 285
monitoring 285
lighting
corridor 265
stairway 265
Luminous rows 289
Service water pump 293
exclusive OR 120
Expansion modules 2, 58
Analog 2
analog 59
digital 2, 59
operating state 55

F

Flag blocks 111
FM 14
Four golden rules 66
Frequency trigger 168
Function blocks 60
Function keys 3
Functions 109

G

Gain 125
GB-2312 194
GF 114
Golden rules 66
Guidelines 17

H

Hiding 90
high-speed counting 37
Hysteresis 181

I

IDEC SmartRelay
connecting to PC 261
guidelines 17
identifying 9
Installing 25
memory and battery
cartridges 247
menus 68, 329
operating states 54
removing 25
software 259
structure of 5
switching on 51
versions 12
without display 325
Inputs 110
Analog inputs 37, 110
connection 35
Cursor keys 58, 112
Digital Inputs 110
Groups 35
inverting 114, 128
unused 64
inputs
High-speed inputs 37
Inserting 87
Installation guidelines 17
Installing
Text Display 30
Interlock 28
Internet address v
Interval time-delay relay/Pulse output 139
Inverter 120
ISO8859-1 194
ISO8859-16 194
ISO8859-5 194
ISO8859-9 194

L

Language
menu 243

Latching relay 190
LCD lifetime
Text Display 320
LED 326
Levels 113
List
BF 109
BN 109
Co 109, 110
GF 114
SF 109, 128
Ln by Ln ticking 199
Logic module 1
Logical inputs 121

M

Math error
analog 230
Memory
areas 103
free 108
limitation 103
requirements 105
Memory cartridge 247
Card --> IDEC SmartRelay 258
CopyProtect 251
IDEC SmartRelay --> Card 254
Memory/battery cartridge 247
Menu language 243
Menu structure
IDEC SmartRelay 329
Text Display 331
Message text charset flag 112
Message texts 193
character set 193
Message ticking 198
Mode
parameter assignment 68, 234
PC-IDEC SmartRelay 261
Programming 68
Mounting
DIN rail mounting 26
Drilling template 29
Text Display 30
Wall-mounting 29

N

Name 77
NAND 116
Negation 120
of a BF input 114
of an input 75
of an SF input 128
Networking
AS interface bus 49
NOR 119
NOT 120
NOT OR 119
Number of AIs 244

O

Off-delay 135
Offset 125
Off-time 152
On-/Off-delay 136
On-delay 131
retentive 138
On-time 152
Open connectors 113
Operating
characteristics 326
Status indication 326
Operating hours counter 164
Reading the MN and OT values 166
Operating mode
Changing the operating mode 66

Programming mode 69
OR 118
Order numbers 333
Outputs 110
Analog outputs 111
blank 58, 111
connecting 44
Digital outputs 110
Overflow error 230

P

Parameter 235
Inputs 122
selecting 236
Set Param 235
setting 233
T 122
Parameter assignment 89
Parameter assignment menu 234
Parameter assignment screen form 152, 198
Parameter protection 124
Parameters
modifying 237
parameters
showing/hiding 90
Password
assigning 78
changing 80
deactivating 80
wrong 81
PC cable 261
USB 261
PC-IDEC SmartRelay 261
PI controller 216
Planning 67
Power
on/off 51
Power supply
Text Display 34
Program cycle 321
Program memory 103
Program module (card)
copying 256
Enabling the security function 251
inserting 252, 253
removing 252, 253
Security function 250
Program name
change 77
character set 77
read 235
Programming menu
AQ in Stop 94
AQ type 95
Clear Prg 96
Edit Name 77
Edit Prg 70
Password 78
Programs
modifying 86
Protection mode 90
Pulse
Pause 141
width 141
pulse generator
Asynchronous 142
Pulse output 139
Pulse Width Modulator (PWM) 222
PWM 222

R

Random generator 144
Recycling 15
Relay outputs 44, 317
service life 317
switching capacity 317
Removal 28

Resources 105
Retentive memory 103
Retentive on-delay 138
Retentivity 123
  enabling/disabling
    Retentivity setting 90
Rules
  four golden 66
RUN mode 84

S

Sensor Characteristics 35
Sensor connections 38
Set clock 240
Setting
  Default values 239
  Display contrast 241, 243, 244
  Start screen 245
  time 90
  Time-of-day and date 240
Setting the date 239, 240
Setting the time-of-day 240
Settings 235
Setup 20
  Maximum setup 20
  with different voltage classes 22
Seven-day time switch 150, 153
  Examples 153
  setting 153
SF 109, 128
SFs
  Delay
    On 131
Shift register 208
Shift register bits 112
Showing 90
Signal status transitions 36
Simulation 259
Softkey 205
Software 259
Special functions 128
  Analog amplifier 185
  Analog comparator 177
  Analog differential trigger 174
  Analog math 225
  Analog math error detection 230
  Analog multiplexer 210
  Analog ramp control 212
  Analog trigger 171
  Analog value monitoring 182
  Analog watchdog 182
  Basics 121
  Counter
    Operating hours counter 164
    Up/down counter 161
  Current impulse relay 191
  Delay
    Off 135
    On/Off 136
  Edge-triggered interval time-delay relay 140
  Frequency trigger 168
  Interval time-delay relay/ Pulse output 139
  Latching relay 190
  Message texts 193
  PI controller 216
  Pulse generator
    asynchronous 142
  Pulse Width Modulator (PWM) 222
  Random generator 144
  Retentive On-delay 138
  Seven-day time switch 150
  Shift register 208
  Softkey 205
  Switch

Comfort 148
Stairwell light 146
Twelve-month time switch 155
Stairwell light switch 146
Start 84
Start screen 245
Startup characteristics 326
Startup Marker 111
Stop 234
Subunits 25
Summertime 97
Summertime/wintertime conversion 97, 239
Clock 97
enabling 98
S/W Time 97
user-define parameters 100
Switch
Dual-function switch 148
Stairwell light switch 146
Switched current
maximum 45
Synchronization 101, 239
'Sync' 101
'Clock' 101
enabling 102

T

T
Parameter 123
Technical data 297
FL1B-J2B2 318
FL1B-M08B1S2 307
FL1B-M08B2R2 314
FL1B-M08C2R2 302
FL1B-M08D2R2 312
FL1D-K2B2 319
FL1D-K2BM2 319
FL1E-B12RCA 309
FL1E-B12RCC 299
FL1E-B12RCE 314
FL1E-H12RCA 309
FL1E-H12RCC 299
FL1E-H12RCE 314
FL1E-H12SND 305
general 297
Text Display 320
Text Display 3
Backlight lifetime 320
display 13
Display lifetime 320
function keys 3
installing 30
menus 331
power supply 34
power-up screen 3
voltage 13
Ticker 198
Time response 122
Timebase 89, 122, 132
Timer 1
accuracy 123
Timing inaccuracy 123
Transistor outputs 44
Trigger
Analog differential trigger 174
Analog trigger 171
Frequency trigger 168
Twelve-month time switch 155

U

Underflow error 230
Unused connectors 59, 64
Unused inputs 64
Up/down counter 161
Upward compatibility 249
URL v
USB 261

V

Verification 91
Voltage levels 113
Voltage supply
    connecting
        Circuit protection 34

W

WindLGC 260
Wintertime 97
Wire ferrules 32
without display
    PC-IDEC SmartRelay mode
        261
    reading current data 327

X

XOR 120

Z

Zero division error 230
Zero offset 125